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Saving *un Milliard*

It is a matter of extreme difficulty to estimate the commercial results of co-operative research, and it was a matter of real interest to read in *L'Usine Nouvelle*, as a result of work done by the *Centre Technique des Industries de la Fonderie*, that scrap production has been reduced in the French foundry industry by one per cent. This has resulted in a gain to France's national economy of a "milliard" of francs, or £1,000,000,000. It would not be unfair to presume that the corresponding efforts made in this country by the British Cast Iron Research Association and the British Non-Ferrous Metals Research Association have conferred similar benefits—if only they could be assessed. Beneficial results from co-operative research are not usually to be associated with single epoch-making inventions, but rather with the higher level of technology which permeates the whole of the industry serviced.

This "milliard" of francs, saved by French industry, will not be equally shared amongst all the foundries, for some, the more progressive, will have achieved a higher percentage. So, too, it is obvious, when visiting foundries in this country, there is the same variable application not merely of results, but of established good technological practice. We have been amazed to see the progress realized in shops, where skilled moulders are in short supply, to see how what might be designated "masonry"—using oil-sand block cores—has captured the field with excellent results. Other concerns, concentrating their efforts on the use of modern systems of running and risering castings, have either reduced their mass or diminished scrap losses. A third pleasing advance is the good results achieved when using inferior raw materials. These, and similar factors, are consequent upon improved technical knowledge, originally emanating from co-operative research, plus, of course, the equally important factor of its dissemination through the technical institutes and Press.

All this reads well for the members of the foundry industry, but there is the other side of the picture, which clearly indicates that much remains to be done. We are not satisfied that our compatriots are availing themselves sufficiently of the work originating in this country on the application of the basic lining to the cupola using the results of Renshaw's researches. The Americans have used this work fully to their great advantage. At the Spring Meeting of the Institute of Vitreous Enamellers, there were many complaints as to the deterioration in the quality of the castings they are now receiving. Again, when travelling with some oil-industry engineers, they were not at all satisfied with the castings now being delivered. From this industry, being somewhat international in character, the complaint is not confined solely to castings of British origin, but to those from all sources. Thus, whilst good progress has been registered, the need for more and more research is still pressing and the prize to be won by the industry is at least a second "milliard."

Mechanical Handling Exibition

Every type of equipment to enable industry to increase productivity at low capital cost can be seen —much of it working—in the third Mechanical Handling Exhibition which the Minister of Labour, Sir Walter Monckton, opened at Olympia, London, yesterday. Exhibits include a crane controlled by radio and television; electronic inspection and counting of tins on a moving conveyor; a pneumatic tube carrying small tools, as well as documents, and acoustically controlled; a wagon tippler, turning a full-size railway truck upside down; a pneumatic grain-handling plant in operation; a fork-lift truck lifting 5 tons; a loading ramp of adjustable height; a 10-ton mobile crane; and numerous hoists and conveyors in operation.

It is interesting to note that apart from reports dealing specifically with freight and materials handling, 27 productivity teams visiting the United States have devoted 30,000 words of their reports to emphasizing the importance of mechanical handling. The exhibition closes on June 14.

Film Review

Conveyors as Your Servants. This film had its first showing last week. It has been prepared by the Mechanical Handling Engineers' Association of 94 and 98, Petty France, London, S.W.1, to lend support to the Mechanical Handling Exhibition which opened at Olympia yesterday. In general the film deals with the lighter industries and includes the operations of a wide variety of conveyors for the making of Swiss rolls; ice cream; brewing; leaf-spring making; wool preparation; motor-car body construction, and cycle component assembly.

It would have been wise to introduce some connection, by links between changes of the sequences, from one industry to another, in order that the viewer could adjust his thoughts. The commentary given by Mr. McDonald Hobley was commendably good. The film, which takes 35 min. to show, can now be borrowed by seriously-interested organizations, and works.

V. C. F.

British Standards Year Book

The 1952 edition of the British Standards Year Book has recently been published. It contains a complete list of the 1,800 British Standards current at March 31, 1952, with a brief description of the subject matter of each as well as an index. It also gives particulars of of the membership of the general Council and of the Institution's divisional councils and industry standards committees, 59 in number. These each represent a major British industry through whom the work of drafting British Standards is delegated to some 2,200 technical committees and sub-committees. In addition 20 special committees, some of an advisory category, are also listed. Copies of the Year Book may be obtained from the British Standards Institution, 24, Victoria Street, Westminster, London, S.W.1, price 7s. 6d.

Latest Foundry Statistics

According to the Ministry of Supply, the production of sand-cast aluminium castings during March was 2,618 tons. Gravity-die-castings amounted to 3,859 tons and pressure-die-castings 952 tons. The magnesium castings produced weighed 270 tons. Corresponding aggregate productions for the first three months of the year were 7,260, 12,161, 2,991 and 864 tons.

Farm Scrap Drive

A renewed drive for the collection of scrap from farms will begin shortly. With the defence programme getting under way, demands for steel are greater than ever and every ton of scrap can play its part as new steel. The amount of scrap from farms is relatively small, but it is an important marginal tonnage which can help to keep furnaces going at a critical time. It is in the nation's and our own interest to search it out now. Farm-machinery displays link farming with the iron and steel industry. Scrap becomes even more important to the farmers when it is realized that it takes some 1¼ tons of steel and cast iron to make a four-wheeled tractor. A combine harvester requires about 2¼ tons, and a two- to three-furrow plough about 8 cwt., and a single-furrow plough 7 cwt. It is believed that scrap from farms in the vicinity of consuming works is cleared with reasonable regularity, but on almost every farm, especially in the remote areas not normally covered by merchant activities, there is some unwanted scrap lying in barns and fields. In the United Kingdom there is a total of 447,566 holdings. If it be assumed that all the scrap lying about the farms averages about 10 cwt. per farm, it could therefore produce something like an additional 200,000 tons of scrap.

Gairloch Industry

Our Scottish correspondent wonders if the new hydro-electric scheme which was officially opened on May 29 at Gairloch, Ross-shire, will revive some of the industry that once thrived in the area. More than 300 years ago, 13 ironworks operated in Ross-shire—eight of them in Gairloch. Hills, with their water-power potentialities, which have now brought electricity to the area, were also the deciding factor in the location of the iron industry. Older works were built high up on the hillsides to take advantage of the prevailing winds for blast purposes; and later works were placed near streams. Dams and sluices were built at several of the streams to maintain the water power used for working the hammers. Ore used in the Ross-shire ironworks was originally bog iron found locally. It was formed by the action of water on iron-bearing rocks and accumulated at the bottom of peat bogs. Later, ore was imported from the south of Scotland, Cumberland and Lancs, and an "export" trade was started which earned for Gairloch the title of the "Black Country." It is unfortunately unlikely that industry of such magnitude will return to Wester Ross. The parish of Gairloch now has a population of only 1,991—less than a third of its population a hundred years ago.

Uses of Ductile Iron Increasing

A Mutual Security Agency extract from the American Press states one foundry reports that in its annealed condition, ductile iron castings can be machined at 20 to 25 per cent. savings over castings of grey iron. Another, manufacturing rolls for printing presses requiring smooth finish and perfect balance, has found that, compared with alloy iron rolls, ductile iron eliminated reinforcing ribs within the rolls. Better surface was obtained, wear on the rolls was more even, and balance was easily maintained. The automobile industry has found the material superior to cast iron and cast steel in the manufacture of large dies. The ease of accurate casting and the subsequent easier grinding of ductile iron is replacing the expensive contour machining in shaping cast steel dies, and the ductile iron dies have proved harder and longer wearing.

Castings to Resist Abrasive Wear*

By E. J. Brown, A.I.M.

In all cases, abrasion-resistance is a comparative quality, but there are types of service requirements for which it is possible to postulate suitable qualities of resistant materials from experience of a number of applications. Corrosion and hardness are but two of the factors to be considered. After a general introduction on these lines, the Author shows the way in which manganese-steel as well as alloy cast irons and other alloy steels have been developed to meet a number of service conditions and goes on to give in some detail the manufacturing methods and applications for these materials. Finally, flame hardening, nitriding and surface deposits of abrasion-resisting material are considered.

FIG. 1.—*Groove worn in Three Weeks by Worsted passing through the Eye of a "Flyer."*

Introduction

Primarily, wear might be regarded as a surface phenomenon which occurs between one or more moving parts. It is not, therefore, a simple dimensional change but a loss, for the most part metallic, of the part in question. It is well-known that types of non-metals when in contact with metals under appropriate conditions will cause wear or loss. Fig. 1 shows a homely example of wear which takes place by traversing worsted. The groove shown has been cut after three-weeks operation, the part in question being the eye of a "flyer," used in the woollen industry. Abrasion in its widest sense should include losses incurred in the multitudinous metal to metal devices involving friction and operating in world-wide applications—the wear on razor blades; the tyres on motor cars; printing plates wear out against paper and ink; whilst the action of steam as in the case of a turbine blade will cause loss of weight.

If one, for instance, is considering the mechanism of wear involved in a particular service, say the crushing of rocks, the process of trial in error is expensive and tedious and much may be done by anticipating both the characteristics of the material to be crushed and the type of steel or alloy which will be most resistant in service. The particular outfit must be intelligently anticipated, taking into account the nature and size of the desired product. To revert to wear as related to the subjects under discussion, it may be defined as an undesired removal of the surface of the metal by frictional force.

Corrosive Influence

Corrosive influences cannot be divorced from wear mechanism. It is well known that chemical and galvanic action changes take place which result in surface attack, the products often being mechanically removed from the sphere of action. Thus a contributory factor is surface oxidation, which must be recognized as an aggravating medium. It has been found for instance that chromium introduced in appropriate amounts into grinding balls compared with carbon steel of equal hardness confers longer service under atmospheric or other oxidizing conditions. Under non-oxidizing conditions the wear is found to be approximately equivalent.

The combination of both wear- and corrosion-resisting properties are frequently demanded in such cases as the propulsion of sandy or alluvial materials, the liners or sleeves of reciprocating pumps etc., for a similar object. In such cases, whilst high resistance to wear is a very desirable feature, this quality may be secondary to the demands required to resist corrosion. Whilst outside the question of wear resistance, it is of interest to record that corrosive attack may be accelerated by the agency of micro-organisms associated with iron and sulphur in particular. Their contribution to corrosion is thought to be due to the erection of a barrier which maintains an oxygen concentration between the metal and the solution.

Hardness of Metals and Wear

Hardness in metals is usually of major importance in relation to wear-resisting properties, and, in general, some reasonable correlation can be obtained between this property and loss of weight in service. Under certain conditions however, this relationship definitely breaks down, the properties of extreme ductility as in the case of mild steel or rubber being effective under certain conditions. The high degree of hardness seems to exert its influence in preventing an abrasive material from getting a "bite."

* Paper presented to the Sheffield branch of the Institute of British Foundrymen.

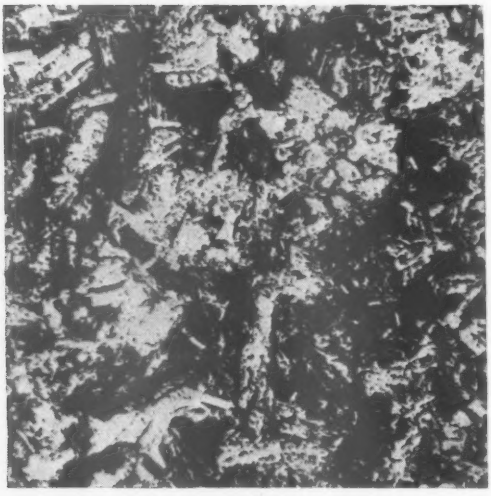


FIG. 2.—*Natural Structure of Quartzitic Rock, which is Highly Abrasive.*

If such particles, by reason of the inherent hardness, cannot get a grip they simply slide off; hence the value of hardness. If however, they penetrate the surface, the property of ductility becomes effective because the surface will flow under impact and will not decrepitate as with hard material. Conditions exist where even mild steel will give a surprising degree of success due to its property of plastic flow.

Crushing of Rocks

Fig. 2 illustrates the natural structure of a very hard quartzitic rock which is extremely abrasive in character. The influences affecting the abrasive properties of rocks are the nature of the fine-grained matrix, and the hardness and toughness of the crystals defined in the aggregate, in other words the cementing material and the cutting constituent. Of these it is generally accepted that toughness is the most important factor.

As distinct from the hardness of a metal which can be determined by the rebound of a diamond-pointed hammer (sclerescope) or by the penetration of a steel ball (Brinell) the hardness of a rock cannot be measured by these means. A static load applied to a rock would merely cause a shattering effect along neighbouring crystalline boundaries. The abrasive resistance of a rock can generally be evaluated by a number of tests, among which is the Page Test which consists of a standard weight which is dropped from successive heights on to a test piece which is carried on a block of standard inertia, the height in centimeters of the blow causing rupture represents the toughness of the specimen. Coupled with the toughness tests, a further measure is the compression test, which means the energy required to disintegrate under a compressive load. It is claimed that the two values can be approximately correlated with field tests.

The hardness of a rock, which is not of necessity a measure of its ease of disintegration, is obtained by comparative means, namely, the ability of one specimen to scratch another, the particles of the softer being torn away by the harder. This gradation which is known as Moh's Scale is expressed as follows:—(1) Talc; (2) Gypsum; (3) Calcite; (4) Fluorite; (5) Apatite; (6) Orthoclase; (7) Quartz; (8) Topaz; (9) Corundum, and (10) Diamond.

The position on the hardness scale cannot be taken as an absolute guide to the destructive action of a rock on a wearing part; in other words it is not safe to judge from that standpoint alone. A very rough classification can be made progressively as follows:—(a) Lime stones and shales least destructive; (b) sand stones, feld spar and hornblend; (c) basalts, flints and grit stones, and (d) quartzites and granites.

Within the classification mentioned above, are wide variations. It may however be broadly assumed in practice that a hard brittle material will be fractured by a smaller number of crushing strokes and with less total pressure than an elastic substance.

Measure of Abrasive Resistance

Figs. 3 and 4 indicate a method by R. D. Haworth of determining quantitatively the resistance of metals to dry or wet abrasion under laboratory conditions by allowing a stationary specimen to be subjected to the action of a revolving disc, whilst the particular abrasive medium is fed in a continuous stream at the area of contact. The specimen must of course be kept under constant load. The disc may be made of iron, but rubber is also suggested. A number of variables must be taken into account; first, if tests are carried out in a dry condition a fairly rapid increase in temperature of the specimen takes place which may result in some softening. As a consequence, moisture must be added, the tests therefore not

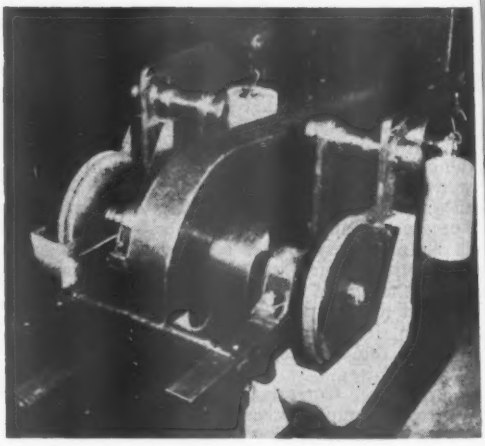


FIG. 3.—*Quantitative Abrasion-testing Machine developed by R. D. Haworth.*

necessarily being carried out under service conditions. The angularity of the abrasive medium has a marked influence on the rapidity of wear.

Pattern of Wear

Fig. 5 shows a pattern which has developed on a paddle used on a Sandslinger. The influences bringing about the ripples are somewhat intriguing but it is conceivable that they arise from harmonic motion. In this respect it is significant to note that alloy cast iron is more prone to wear in waves than hardened steel.

Manganese Steel

Austenitic manganese-steel is a non-magnetic alloy possessing extreme toughness, coupled with a unique capacity for work hardening. The composition is usually as follows:—C, 1.0 to 1.3 per cent., and Mn, 11.0 to 14.0 per cent.

In common with all steels of this type, it is not hardenable by normal heat-treatment methods, the means of raising this hardness being by the application of some process involving cold deformation. This property, together with its high ductility, renders manganese-steel particularly suitable for conditions where hammering is encountered, and under such conditions it is not unusual for the Brinell hardness to be increased from 200 to 550. Without work-hardening, metals can only show resistance to abrasion which is commensurate with the initial hardness, but it should be emphasized that manganese-steel when put into service is comparatively soft.

Austenitic material, manganese-steel does not exhibit a true yield point under static loads as it is found that permanent set arises at comparatively low values, thus rendering it unsuitable where high tensile loadings are encountered. Therefore, for design purposes the maximum stress to which it can be subjected should not exceed 8 tons per sq. in. in tension, and 5 tons per sq. in. in torsion. The tensile properties of manganese-steel do not of necessity form a criterion on which its performance can be assessed; under average conditions, however, the minimum values obtained are: maximum stress 55 tons per sq. in. and elongation 40 per cent.

Manganese-steel is very difficult to machine, although the advent of tungsten-carbide tools has done much to render this an easier proposition. Nevertheless, it is desirable that machining is kept to an absolute minimum in the interest of economy, and wherever possible, as in the case of castings, it is desirable to use cores to their fullest extent.

Hardening of Steel by Work

It was considered for some time that the increase in the hardness of metals brought about by impact, or other means of energy, could be credited to the formation of martensite. It has been since demonstrated, however, that some actual deformation of the austenite occurs, which feature is aligned with the hardening which takes place. Fig. 6 illustrates two photomicrographs of manganese steel, one consisting of austenite as obtained by water quenching from 1,050 deg. C., the other demonstrating the structural effect resulting from the application of hammering. With regard to the

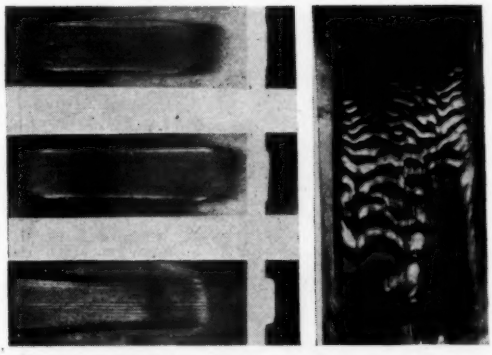


FIG. 4 (LEFT).—*Effect of Abrasive Wear on Specimens tested on the Haworth Machine;* FIG. 5 (RIGHT)—*Pattern of Wear developed on a Sandslinger Paddle Wheel.*

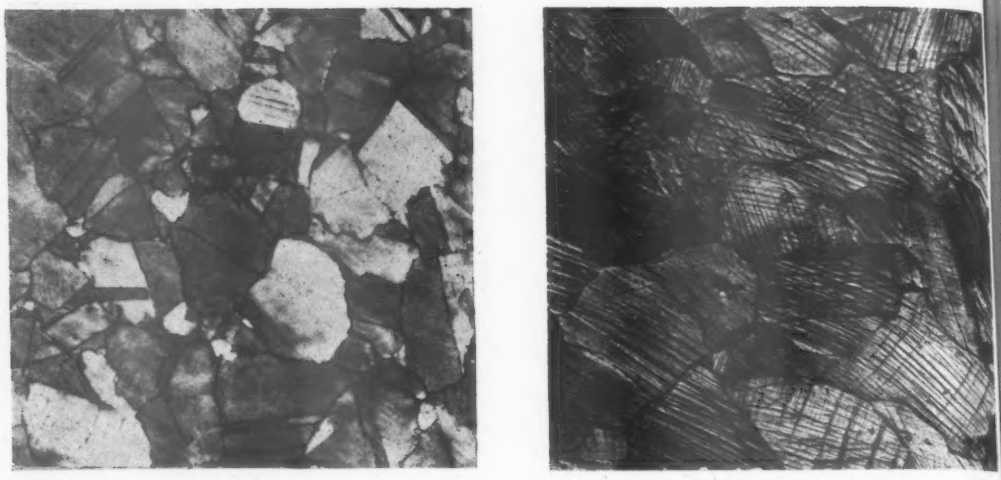
latter, it will be observed that within the compass of each individual austenitic grain are bands of what are described as "slip," each being separately oriented and not necessarily following an overall pattern. It is claimed by some authorities that slip or inter-grain distortion takes place in planes which possess the greatest atomic density. It has been long known that the atomic structure of all metals follows a definite pattern, ferrous types are assumed to be cubic in form and the slip which takes place may be related to this structure.

Heat-treatment of Manganese-steel

It has been previously mentioned that manganese-steel does not respond to normal heat-treatment practices, and in order to render it in the best possible condition it is necessary to water-quench from a temperature of approximately 1,050 deg. C., although it is possible to resort to air-cooling in the case of ruling sections below $\frac{1}{4}$ in. It should be emphasized that intermediate temperatures result in the precipitation of carbides which result in brittleness, and under no circumstances should any of these steels be subsequently heated in excess of 300 deg. C. The wide field for this type of steel where operating conditions involve surface impact are indicated in castings as follows:—Jaws for jaw-breakers; mantles for gyratory crushers; liner plates for ball and rod mills; dredging plant, such as buckets and tumblers; dredger pins; and miscellaneous items such as:—digger teeth; crane track wheels; elevator chains; liners and screen plates. An interesting application of a manganese-steel casting is that of cases for lifting magnets where its non-magnetic properties are utilized.

Improved Manganese-steel

Where conditions of service are of extreme severity, in addition to work hardening, some spreading of the parts is liable to occur. To obviate this characteristic, the initial hardness can be raised by 40 points Brinell from 200 to 240 by the additions of carbide-forming elements such as chromium, vanadium, etc. Thus, whilst the resultant



(*a*) (*b*)

FIG. 6.—(*a*) *Austenitic Structure of Manganese-steel;* (*b*) *Structure of Similar Material after Deformation by Impact.* (*Both* ×100 *mgs.*)

hardness from work applied is in no way affected, a stiffer initial background with obvious advantages is obtained.

Fig. 7 illustrates a casting which is a swing hammer in manganese-steel. The operative conditions consist of an assembly of two or four hammers which are free to swing on the periphery of a drum and are held in a radial position by the action of centrifugal force. The drum is revolved at a speed of about 700 r.p.m. in order to maintain the desired force, " resultant hardness " is produced on the parallel portion of the hammer. Fig. 8 illustrates a diagrammatic section of a hammer which has been heavily worn. The hardness range is clearly shown, as high as 440 Brinell being recorded on the worn face. The values shown were determined by the use of a 1-mm. ball.

Atmospheric Head

The use of the atmospheric head, the principle of which is well known, has been applied with great success to the making of manganese-steel castings. This head, which combines the advantages of both open and blind risers, depends upon the introduction of atmospheric pressure beneath the solidified periphery of the head by the presence of a puncture core. (Fig. 9.) After casting, a solid wall of metal forms round the entire mould cavity, and as the liquid which remains inside this solid envelope continues to shrink, a vacuum is created and the envelope gives way at its weakest point, which is at the end of the puncture core. Atmospheric pressure is brought to bear on the liquid in the head through the pores of the mould and puncture core. Atmospheric pressure in a closed system of this nature is theoretically capable of feeding metal to a height of over 4 ft. and in practice such heads frequently feed successfully to heights above the top of the heads themselves. The method thus presents obvious advantages over the gravity method of feeding castings.

FIG. 7.—*Cast Manganese-steel Swing Hammer.*

Washburn Core

The application of the Washburn core has also turned out to be particularly applicable to the manufacture of manganese-steel castings. The thin wafer core is inserted into the mould across the neck between the head and the casting. Provided that the core is sufficiently thin in relation to the dimensions of the head it will attain a high temperature from the molten metal and the relatively small aperture in the core will be kept open for feeding to be completed. The effects can then be much the same as if the core were absent altogether. After casting, the head can be knocked off instead of being removed by oxy-acetylene or any other method. This entails economy in a number of directions, besides the elimination of the cutting operation there will be a reduction of the amount of molten steel require

for feeding purposes. The two methods mentioned, namely the atmospheric head and the Washburn core are now combined, and widely applied in the making of manganese-steel castings, their use resulting in considerable economies in production. The accepted procedure in the development of such methods is to make a pilot casting and prove the soundness by X-ray examination before final adoption.

The removal of feeder heads from castings in manganese-steel can be somewhat hazardous, particularly those from large types such as buckets and tumblers. If these are removed in the "as-cast" condition, by the conventional method of burning with oxy-acetylene, some cracking is highly probable. It has been a general procedure therefore that the operation of head removal should be carried out after water-quenching from 1,050 deg. C., or when the steel is fully austenitic. The introduction of the Washburn core which permits of head removal by "knocking off" has to a large extent obviated this difficulty and promises to be the means of widespread savings. It follows that if heat-treatment can be carried out minus feeder heads there is about 30 per cent. less volume, involving saving both in time and fuel consumed for the process. A further advantage is more efficient treatment by reason of the smaller mass. Fig. 10 illustrates a method employed for the casting of a crusher jaw using both the atmospheric head and the Washburn core.

Alloy Cast Irons

During the last fifteen to twenty years, largely as a result of the application of metallurgical principles, alloy cast irons have been developed and now occupy an ever-expanding province by reason of their excellent abrasive-resisting properties. It is quite safe to say that wherever grey iron is used in this field, consideration should be given to its replacement with the alloy variety. The first means of hardening cast iron was by the introduction of chromium in varying quantities. This, of course, whilst being effective and rendering better wearing properties, imparts an unusual amount of brittleness, and such material therefore will not withstand shock conditions.

Structurally, alloy cast irons with particular reference to the nickel/chromium variety contain a multitude of refined and well-distributed carbides which make an important contribution to their abrasive resistance. As distinct from steel, it is virtually unmachinable. It is not intended fully to detail the metallurgical principles of the alloys as there are many well-known references, but it may be stated that the presence of nickel hardens and strengthens the matrix in white iron just as it does in grey iron but it should be remembered that it is a graphitizer, thus will act as a softening agent if added to excess. This tendency must, in order to ensure hardness, be balanced by the simultaneous addition of chromium or some other carbide-forming elements.

One limitation of the applications of such alloys is the inability to resist excessive shock loads, and where a change from steel is contemplated some redesigning of the part is often considered advisable.

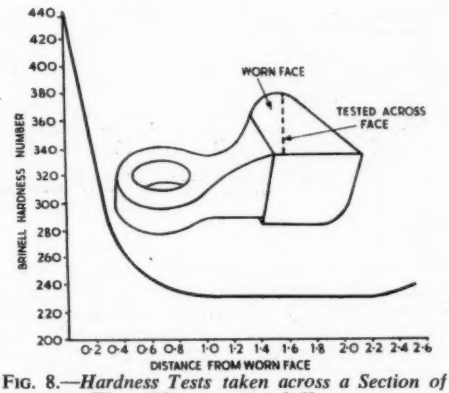


FIG. 8.—*Hardness Tests taken across a Section of a Worn Manganese-steel Hammer.*

It does not follow that a pattern of a part which is designed for steel can necessarily be successful for alloy cast iron. With further reference to the resistance to shock, it was interesting to note, illustrated in an American publication, a drop ball, or what is known in this country as a "tup," weighing 17,000 lb., and which has been made in alloy cast iron.

A further example of the application of alloy cast iron is given in a paper by Mr. C. H. Kain[2] which refers to the use of alloy cast-iron ploughshares. During the autumn of 1947, ploughshares made of chilled cast iron became very scarce by reason of an excessive number of breakages due to the hard and dry condition of the soil. In consequence ploughing for the following year's harvest was seriously in danger and Ni-hard types of ploughshares

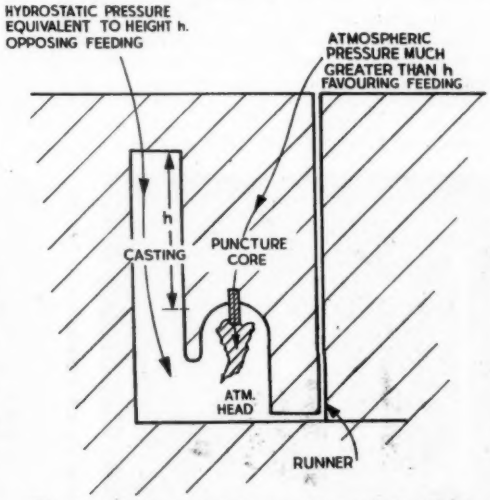


FIG. 9.—*Section through an Atmospheric Head, showing the Mechanism of Feeding by Utilising a Puncture Core.*

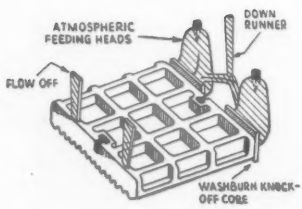


FIG. 10.—*Method of Casting a Crusher Jaw using both Atmospheric Head and Washburn Core.*

were tried out. The ordinary type of chilled iron share has a structure consisting of cementite and pearlite which breaks off or wears away leaving a soft background which rapidly disappears in service. Ploughshares were tried out, the structure of which consisted of a carbide-martensitic formation throughout and gave approximately twice the life with considerably fewer failures due to fracture.

Applications for the use of alloy cast irons are legion and include parts used in a large variety of industries. Among castings which are in common use are liner plates, muller tyres, scrapers, skids, chutes, grinding balls, concaves, etc.

Wheelabrator Blades

A Wheelabrator which is well known to most foundrymen, is a machine for the fettling of castings, and is also used for the process of peening steel and the like. It consists of a paddle which revolves at a high velocity and which contains eight blades, the purpose of which is to propel chilled iron shot with a maximum force on to castings which are to be freed from adhering sand. Wheelabrator blades may be cast using nickel/chrome cast iron which is heat treated by quenching to attain the maximum hardness usually in the region of 900 D.P.H. Fig. 11 illustrates X-ray photographs of blades, both unsound and sound. The unsound blades which contain entrapped sand and slag were cast horizontally, whilst the sound blades were cast vertically, using in the latter case an elongated wedged-shape runner. The purpose of the illustration is to emphasize the necessity for complete soundness, as any imperfection will serve as a starting point for wear and will thus outweigh even superlative metallurgical properties.

Heat-treatment of Alloy Cast Iron

Fig. 12 demonstrates the progressive increase in hardness of nickel/chrome cast iron when related to the carbon content. The hardnesses shown are also related to various treatments, which suggest that the work to which the iron is to be subjected should be considered and the corresponding heat-treatment applied in order that the optimum properties can be obtained. One important feature is that, as the hardness is increased, there is a corresponding reduction in the ductility of the metal. The values shown in brackets illustrate the transverse rupture strength obtained on cast bars 0.875-in. dia.; in other words, the higher the hardness the more brittle or more susceptible to fracture the material becomes. A further interesting feature is the hardness shown and which is obtained from cast bars which were oil-quenched and subjected to refrigeration; it will be seen that this is almost a straight line. The theory regarding refrigeration is somewhat involved and, in order to understand fully the metallurgical details, various time/temperature/transformation curves must be studied. Briefly, it is that the maximum wear resistance or hardness is obtained by the presence of the maximum quantity of fine-grained and well-distributed martensite. (This martensite, which can be seen under the microscope, is a needle-like constituent, being a transformation product when cooling has taken place from high temperatures.) This transformation does not of necessity take place progressively, although it is generally illustrated from high temperatures as following a pattern which can be likened to the letter "S." It would seem obvious that the application of such alloys to low temperatures is the means of inducing some further transformation, probably approaching the maximum, and this feature is responsible for the higher hardness values obtained. Further reference to Fig. 12 will show that, whilst there is a corresponding increase in hardness in relation to carbon on the four heat-treated but not refrigerated specimens, this relationship does not hold with the specimens which were subjected to low-temperature treatment. In other

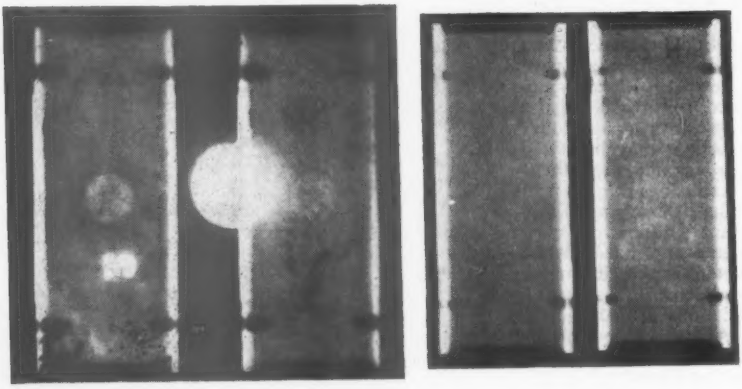


FIG. 11. — *X-ray Photographs of Wheelabrator Blades; (left) Unsound, (right) Sound.*

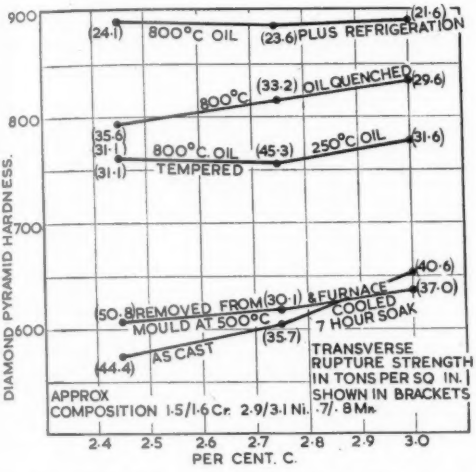


FIG. 12.—*Relation of Hardness and Carbon Content in Nickel/Chrome Alloy Cast Irons.*

words, it cannot be explained, due to insufficient work being carried out, how far the line would proceed to the left without descending. It is obvious that further study is desirable.

Alloy Steels

When chromium is introduced into steel or iron, rather complex chromium-iron carbides are formed which are set in a matrix of chromium-iron solution. The amount of primary or more or less free carbide increases as the carbon increases. These chromium carbides are extremely hard and confer excellent wear-resisting properties. Chromium steels are thus widely used for this purpose, coupled with their ability to resist shock load. A common composition is carbon 0.7 to 0.8 per cent. and chromium 1.0 per cent. Fig. 13 illustrates the method of casting of an outer disc used on a swing-hammer crusher which is cast to the composition mentioned. Where a high degree of rigidity is required and where conditions do not permit of work-hardening, nickel-chrome-molybdenum steel castings find a useful application. Digger teeth operating in a comparatively soft clayey soil are a typical example, when suitably heat-treated to the degree of hardness necessary for the operation.

High-chromium Irons

An interesting material which has probably not been fully exploited as a wear-resisting medium is the high-chromium series, *i.e.*, approximately 25 per cent. Such a composition is well known for high-temperature applications and there are grounds for assuming that since frictional heat generated by abrasion softens metals, and thus accelerates wear, the high hardness and heat endurance of high-chromium iron is responsible, or at any rate a factor in its unusual resistance to wear. A further feature of the composition is its remarkable stability. When carbon is increased to 2.0 to 3.0 per cent., such a composition may be regarded as a cast iron, the

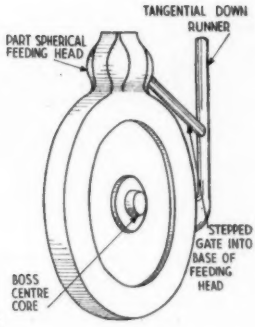


FIG. 13.—*Method of Casting a Disc used on Swing Hammer Crusher.*

major distinction, however, being the absence of free graphite due to the high affinity of chromium for this element. Incidentally, these compositions possess excellent "castability," the shrinkage properties being very low. The following gives the effect of varying percentages of carbon on the strength and hardness.

25 Per Cent. Chromium Iron Series.

Carbon, per cent.	As cast.		Oil quenched—1,000 deg. C.	
	Hardness, D.P.H.	Transverse rupture, tons per sq. in.	Hardness, D.P.H.	Transverse rupture, tons per sq. in.
1.05	275	66.6	432	32.2
2.88	613	33.6	830	31.4

It will be seen that the low-carbon material possesses relatively high transverse properties, but these rapidly decline with increasing carbon. When these specimens are oil-quenched, the hardness values materially increase, but the rupture strength is sacrificed as a consequence.

One very useful feature of the high-chromium type of material is that by judicious heat-treatment

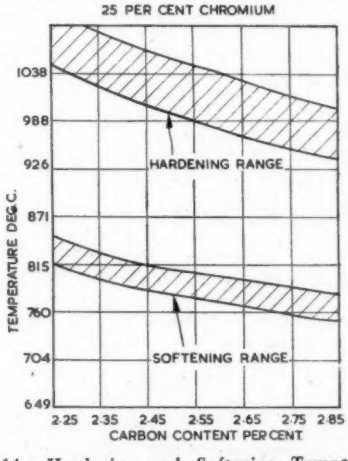


FIG. 14.—*Hardening and Softening Temperature Ranges for Castings of Various Carbon Contents of High-chromium Cast Irons.*

FIG. 15.—*Machined Cast Worm, in High-chromium Iron.*

it can be softened to enable machining to be carried out. Fig. 14 illustrates diagrammatically both the softening and hardening range. The temperatures shown on the chart are somewhat critical and must on no account be exceeded. Hardening can be subsequently carried out with a negligible amount of scaling and distortion. An essential to ensure maximum hardness is rapid cooling, and in the case of very thin sections air-cooling will suffice; but oil-quenching is necessary as a general rule. In the heating-up of the specimen the necessary transformation mechanism is sluggish and it is advisable to hold at temperature for a relatively long time. Fig. 15 shows a photograph of a cast worm used for the propulsion of sandy and alluvial material, which was cast, annealed for machining, and hardened in the manner described.

Flame Hardening

Any steel or cast iron may be considered potentially suitable for flame hardening provided that the combined carbon is in excess of 0.35 per cent. The process, simply described, consists of traversing the surface of the metal with a carefully coordinated series of burners, followed by water jets. Skill and ingenuity have been devoted to the process, and when first practised much difficulty of control was experienced resulting in irregular zones lacking uniform hardness.

The maximum hardness obtained is primarily dependent on the combined carbon, values of over 500 D.P.H. being attained on 0.40 to 0.5 per cent. carbon steel, whilst 650 to 850 D.P.H may be obtained from a carbon content between 0.5 and 0.6 per cent. Hardening depth depends on a number of factors among which are the rates of traverse.

Alloy cast irons react favourably to flame hardening, but as in steel it is again essential that the combined carbon content should be approximately 0.6 per cent. or more. As distinct from steel, however, the effects of a relatively ductile core will be lacking and for this reason, coupled with the fact that cast iron is already inherently hard, or can be made so, applications are not very numerous.

Nitriding

The process of nitriding consists of subjecting finished and machined parts to the action of nitrogen at a temperature of 500 deg. C. or thereabouts for periods up to 90 hours. Ammonia gas is used as a source of nitrogen. The parts to be treated are placed into gas-tight boxes, the necessary inlet and outlet tubes being incorporated. Whilst the temperature is maintained, the positive gas pressure of about ½ in. water is kept up.

There are several iron/nitrogen compounds capable of formation, but certain alloy additions are desirable to ensure stability of the hardened skin. Research has shown that aluminium is most potent by reason of its great affinity for nitrogen. Chromium and molybdenum have also strong nitrogen combining characteristics. Whilst, therefore, steel of almost any composition may be nitrided, the most desirable results are obtained from steel containing proportions of these elements. The thickness of the hardened skin varies between 0.1 and 0.3 in. according to the duration of the treatment. The process has found numerous applications such as for automobile cylinders, pump liners, whilst in the brick-making industry nitrided liner plates are sometimes used.

Welded Deposits

Increased resistance to wear may be obtained by the deposition of hard-facing material on to the parent body by means of welding. There are several types of rods which may be broadly classified:—(*a*) Ferrous alloys, mild steel, austenitic chrome/nickel steel (18-8); (*b*) non-ferrous alloys which include the stellite type; and (*c*) carbides, usually in the form of mild-steel tubes containing granules of tungsten carbide. The carbide or hard metal rod, as it is generally termed, can be used on many articles such as coal-cutter picks, agricultural implements, excavator teeth, etc. The deposit is usually applied by use of gas, as arc welding may result in overfusion of the tungsten carbide grains. The hardness of the matrix may be in the region of 500 to 700 D.P.H. whilst the micro-hardness of the

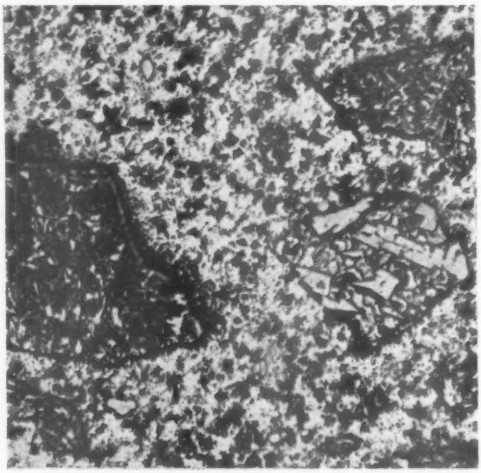


FIG. 16.—*Photomicrograph of a Weld Deposit comprising Tungsten-carbide Particles in an Alloy-steel Matrix.* × 100.

tungsten carbide may approach 1,600 D.P.H. Fig. 16 is a photomicrograph of a weld deposit comprising carbide in a hard alloy-steel matrix.

Summary

The many problems relating to wear have been but superficially covered, but generalizations are more or less unavoidable as resistance to abrasion cannot be accurately specified outside the peculiar operative conditions. It may be desired to break down chalk which as a mineral is relatively soft but it may contain a small percentage of flint, in which case it is the factor to be considered. Clay and ganister will vary from site to site. Coke, for instance, can be highly abrasive, due to its hardness and irregularity, and the fact that it will not impart any high degree of work-hardening.

The properties of manganese-steel, alloy cast iron and steel, of the high-chromium variety, have been outlined. Each has its particulár application, although there is considerable overlapping in the province of each. It is hoped that the method of making manganese-steel castings described will have more than a passing interest to steel foundrymen. It is put forward that the heat-treatment of alloy cast iron might be given some further thought. It is also considered that the 25 per cent. chromium iron has potentialities, one particular reason being because of its machinability and subsequent hardening properties.

The Author's thanks are expressly due to Mr. E. W. Colbeck, M.A., F.I.M., and his colleagues on the board of Hadfields, Limited, for permission to publish this Paper.

REFERENCES

[1] R. D. Hayworth, Junior. Vol. 41. Trans. A.F.M., 1949, p. 819.
[2] Sanders, Kain, Hart, Hardy and Gordon. I.B.F. Proceedings, 1949, p. 169.

New Catalogues

Light Alloys.—We have received from the Northern Aluminium Company, Limited, Banbury, Oxfordshire, a 24-page brochure covering the properties of Noral alloys. It replaces the data sheets which the company formerly used to publicize their range of alloys. As would be expected, the bulk of the contents consists of tables, and covers sheets, plates, extrusions, etc., as well as castings. This very useful pamphlet is available to our readers on writing to Banbury.

Ventilation.—Keith Blackman, Limited, Mill Mead Road, London, N.17, have issued an eight-page catalogue covering the Extravent line of window fans. The pamphlet describes and illustrates their types of fans. The first EF1 is a weatherproof fan, the second, of different construction, is the standard line, and the third, EF3, is light-proof and is specially suited for use with dark rooms. Each of these types is available in two sizes. The pamphlet is available to our readers on writing to Mill Mead Road.

Ferro-silicon Briquettes.—The British Electro Metallurgical Company, Limited, of Wincobank, Sheffield, have just issued a four-page leaflet covering the use of ferro-silicon briquettes as a cupola and ladle addition. The quantity to be added to obtain optimum results is based on a residual zirconium content of 0.02 per cent. To accomplish this an allowance for 30 to 40 per cent. recovery is the accepted figure. The leaflet, which is available to readers on application to Wincobank, sets out the advantages to be gained through the use of these briquettes.

Protective Equipment.—A 16-page illustrated catalogue received from Chapman & Smith, Limited, of 15, Highbury Place, London, N.5, must surely negative the oft-heard statement of a man's inability to find a pair of goggles to suit him, for in it there are shown such a diversity of types that everybody can find something to meet his needs. This is an important feature as the wearing of unsuitable goggles is about as pleasant as going for a long walk with a "nail in one's shoe." In addition to this detailing of goggles, there are several models of respirators and masks, but of the former there is a note to the effect that full protection against silicosis is not given through their use. The catalogue is available to our readers on writing to Highbury Place.

Harris & Pearson Centenary

A centenary dinner for staff and employees past and present was held recently by Harris & Pearson, Limited, firebrick manufacturers, etc., of Stourbridge (Worcs). The company was founded in 1852, when 21-year-old George Pearson entered into partnership with Peter Harris. Their first move was to lease the firebrick works known as Withymoor Old Side Works from the Earl of Stamford and Warrington. This plant upon cessation of work in 1928 had been in operation for nearly 200 years. In 1872 land was acquired for the New Side Works which is now producing about 17,000 tons of fireclay refractories a year.

At the dinner Mr. E. G. Smallman, proposing a toast to the company, spoke of the developments 100 years had seen, and referred to the happy relationship that existed between the workpeople and management. In his reply, Mr. R. A. Pearson, managing director, and a grandson of the founder, drew attention to the strength and continuity of the family associations there were within the company, and expressed the wish that this important tradition should continue.

Old Apprentice Scheme

To commemorate the centenary this year of the Birmingham firm, Belliss and Morcom Limited, the Apprentices Association has presented to the Company a Centenary Challenge Cup to be awarded annually to the best apprentice of the year. Among the firm's most storied possessions is an old ledger in which are recorded the names of 1,612 youths who have served apprenticeships. Still in use, the book begins on November 22, 1882, when T. H. Parrott's name was entered. Mr. Parrott later became chairman and managing director of the Company. Lieut.-Col. R. K. Morcom, the present chairman, was apprenticed in 1889; Mr. J. E. Belliss, the present managing director in 1924, and Mr. F. V. Everard, the present works director in 1926. Another apprentice who rose to distinction in the engineering world—Sir Miles Thomas—began his training in 1914. The firm has one of the oldest craft apprenticeship schemes in the country.

THE GLASGOW OFFICE of Alfred Bullows & Sons, Limited, has been changed to 70, Gilmour Street, Glasgow, C.5 (telephone: South 2383).

American Report

Eleven delegates from the United Kingdom attended the 1952 Convention of the American Foundrymen's Society at Atlantic City, New Jersey, U.S.A., during the week of May 1 to 7, as guests of the Mutual Security Agency. The Britons were a part of the 79 representatives of M.S.A. nations who attended the convention. More than 145 guests from overseas were also in attendance, with the majority, other than the M.S.A. contingent, representing their firms at home, but all seeking to increase the industrial productivity of their homelands.

The M.S.A. delegation entered the United States between April 14 and 18, and immediately set out upon a study tour of the American foundry industry. Besides those from the United Kingdom, the group included: seven Belgians, 10 Danes, six Frenchmen, 21 Germans, two Greeks, nine Italians, seven Dutchmen, five Norwegians, and one Turk. The unit from the United Kingdom included: Mr. Lawrence Brown of the Premo Pattern Company, Birmingham; Mr. F. G. Butters, of Bamfords, Limited, Uttoxeter; Mr. John G. Bailes, of William Jessop & Sons, Limited, Sheffield; Mr. John Bolton, British Steel Founders' Association, Sheffield; Mr. H. Morrogh and Mr. W. B. Parkes, British Cast Iron Research Association, Birmingham; Professor A. J. Murphy, Birmingham University; Mr. James L. Mitchell, Mitchell Russell, Limited, Scotland; Mr. J. H. Witham, Tonge & Taggart, Limited, Dublin; Mr. Tom Shanks, Cruikshank & Company, Limited, Scotland; and Mr. Kenneth Batty of Paul C. Fassotte, consulting engineers, Leeds.

Mr. Morrogh, a brilliant metallurgist, who has made several appearances before the Society, was awarded the William H. McFadden American Foundry Society Gold Medal for outstanding achievement in the field of grey iron. He was also the 1947 winner of the Carnegie Gold Medal of the British Iron and Steel Institute, and for the past several years has devoted much effort to the study of the mechanism of the solidification of cast irons, with emphasis on graphite formation. Mr. Parkes delivered the official British Exchange Paper at the conference, and Mr. Bolton has served as secretary for the M.S.A. group.

It was the consensus of the team as a whole that the high productivity standards achieved by the foundry industry in the United States are largely due: (1) To the personal relations between management and labour; (2) to the personal relations between the different levels of managment, and (3) to the training of supervisory staffs especially of foremen, and by the larger number of foremen frequently employed in each American plant. The group noted that American promotion is based much more strictly upon merit and practical ability than is frequently the European custom, and remarked that this leads to proper understanding between different levels of workmen and management. The group also cited the higher "school leaving" age of American youth, and said that the result is not only reflected in scholastic ability but also in the character of the people.

Technical Observations

The M.S.A. group was further impressed with the care with which work is planned in American foundries, and remarked that this care eliminates disruptions and delays once production is in progress. On the technical side the group noted particularly:—(1) American shake-out methods, citing a number of relatively simple and inexpensive mechanisms which reduce physical labour and the size of work crews; (2) American lifting and handling equipment which reduces manual labour and

(*Continued at the foot of col.* 2)

increases production speed, and (3) American pattern equipment, which members found (*a*) of fine quality; (*b*) to embrace extensive use of matchplates; (*c*) that plate-mounted patterns are prepared for but small-quantity orders in order to take advantage of machine-moulding production. The group also found that American use of "pop-off" flasks, widely used for castings in all metals under 120 lb., results in greater speed of production; greater ease of shake-out, and reduction of capital investment as compared with the conventional type of moulding boxes.

The M.S.A. delegation was agreed that much of what they found in America could be used in Europe, although some matters, particularly those of management/labour relations, would face a long delay while European tradition was overcome. The group further noted America's large domestic market, which moving through inter-state commerce without tariff barriers, makes a great production and consequent low price possible. The unit announced its intention to follow up its tour of America with lectures on American methods at home. Many intend to write their findings in the technical Journals of their homelands.

Sir P. Bennett's Resignation

Sir Peter Bennett's resignation from the office of Parliamentary Secretary to the Ministry of Labour and National Service was announced last week. He has resigned for reasons of health. Sir Peter, who is 72, will continue to give the Minister the benefit of his advice on industrial matters. His appointment to office last year meant his resignation from the board of Imperial Chemical Industries, Limited, the Birmingham Committee of Lloyds Bank, Limited, and as chairman and joint managing director of Joseph Lucas, Limited. A past-president of the Federation of British Industries, Sir Peter has also served as a member of the British board of the International Chamber of Commerce, as a member of the National Advisory Council of the Motor Manufacturing Industry, Ministry of Supply, and as U.K. chairman of the Anglo-American Productivity Council.

The new Parliamentary Secretary, Mr. Harold A. Watkinson, is 42 and is M.P. for Woking. By profession an engineer and technical journalist, he has been Parliamentary Private Secretary to the Minister of Transport and Civil Aviation.

Among other changes in junior Ministerial posts announced last Wednesday is that of Brig. H. R. Mackeson, M.P. for Folkestone and Hythe, as Secretary for Overseas Trade. He is the Joint Deputy Government Chief Whip.

Progress on Tyne Iron-ore Quay

The new iron-ore discharging quay at Tyne Dock, South Shields, on which work started about 18 months ago, is expected to be completed early next year. About 3,000 tons of steel will be used constructing the quay and ore-handling plant and when the work is completed imports of iron-ore into the Tyne are expected to reach 1,000,000 tons annually—about twice the existing rate. Vessels up to 20,000 tons dw. will be able to berth at the quay which will be 860 ft. long.

The last report issued by the Tyne Improvement Commission on the progress of the quay stated that 84 per cent. of the sheet piling, 26 per cent. of the quay piling, and 78 per cent. of the bunker piling had been driven, and 22 per cent. of concrete in deck slab, and 54 per cent. of the concrete for bunker foundations had been placed in position.

Association Technique de Fonderie

Annual Congress in Lille

The 25th Congress of the French foundry technical association was held last month at Lille under the presidency of Mr. Muguet, a prominent executive of the Société Anonyme Commentry, Décazeville et Fourchambault. There were about 160 delegates in attendance, including representatives from Belgium, Germany, Great Britain, Holland, and Italy. Altogether 16 Papers were presented, of which four were exchange papers.

First Day

After Mr. Muguet's address of welcome, there was a Paper by Mr. J. Léonard of Belgium, entitled "Porosity—Solidification Period of the Phosphide Eutectic." In it he points out that porosity in cast iron carrying more than a quarter of one per cent. phosphorus can be avoided by adjusting the carbon and silicon contents. The Author's recommendations are that with 1 per cent. phosphorus and carrying 1.5, 2 and 3 per cent. silicon, the corresponding carbon content should exceed the hypoeutectic by 0.15, 0.22 and 0.40 per cent. respectively. A definite statement is made that machinability decreases with increasing phosphide eutectic content—even if the iron shows the same Brinell hardness.

After an excellent luncheon at the Hotel Royale, technical sessions were resumed at the Maison du Commerce. The first Paper was on the subject of the "Correlation between Various Mechanical Tests on Normal Grey Irons," by Etienne Doat and François Danis. This is an introductory report on a large research being undertaken at headquarters to provide proper data for grey-iron specifications—certain formulæ have been derived and are set out. Then Mr. Sautereau read a Paper on the "Use of Strain-gauges in the Steel Foundry," and showed how suitable they could be where normal calculations are not practical. Then followed a Paper by Mr. H. de Leiris on "Fractures in Service of Castings Submitted to Cyclic Stresses." The Author gave to the founder the following advice: "When making castings which have in practice to resist cyclic stresses, attention should be paid to three essential points: (1) Conform rigidly to the specified dimensions; (2) use good sound dense metal and control this denseness by using methods specially appropriate to each class of castings, and (3) ensure the absence of local defects in stressed areas and do not fail to report when they do occur." Professor Le Rolland and Mme. Plenard then presented a Paper on "Some Considerations of the Modulus of Elasticity of Irons." The last Paper to be given was on "Some Remarks on Atmospheric Risers," by Mr. Jean Gelain. This was a thoroughly practical contribution to the subject, using various types of normal foundry alloys.

Second Day

An early start (8.30 a.m.) was made with a Paper on a very interesting subject, "The Life of Clay in Moulding Sands," by Mr. Nicholas. Unfortunately, no preprint is available for this Paper or the next, "Corebinding Materials," by Mr. Meyer. The latter part of this second Paper dealt with phenolic resins—a subject discussed in greater detail in the official exchange paper presented on behalf of the Institute of British Foundrymen which followed. It was written by Mr. G. L. Harbach and Mr. P. G. Pentz and brilliantly delivered by the last named. In order that his audience could have a proper appreciation of the sands used in the work described, a table giving the properties of both French and English sands was shown. Mr. V. C. Faulkner presided for the presentation of this Paper, which was followed by a good discussion. Then came the German exchange Paper by Dr. Franz Roll, under the title of "A Contribution to the Microscopic Examination of Corebinders." The Author has developed a technique using a multitude of chemicals which enables him to check the consistency of various deliveries and the intimacy of the coremixing. It was a very well-illustrated Paper and covered a wide range of materials. The final Paper in this session was on "Mould-drying by the use of Portable Stoves," by Mr. G. Ulmer and Mr. M. Decrop. In it, reference is made to the work of A. Cracknell and F. Cousans, and a fuller explanation is given of the phenomenon of the striking-back of moisture. It was a thoroughly interesting lecture.

After luncheon, there was a visit to the works of Fives-Lille. This is a very large engineering works operating both a steel- and an ironfoundry, the latter using the cement-sand process. This will be dealt with in some detail later.

During the evening, the Congress banquet was held at the Hotel Royale. Mr. Muguet presided and an address was given by Mr. Olivier, the president of the North of France foundry owners association. Mr. Faulkner, on behalf of the visitors, thanked the hosts.

Third Day

The session on the last day was devoted to the presentation of non-ferrous Papers. First of all, Mr. Henry Garnier dealt with "Quench Burns in Heat-treated Light-alloy Castings." This defect arises during heating at temperatures close to the melting point, prior to quenching. The second Paper was "A Study of a Light-alloy Casting submitted to Static and Dynamic Stresses," by Mr. Louis Grand. It deals with the performance of a motor-car component and emphasizes the good service given by a heat-treated alloy containing Si, 9.5; Fe, less than 0.50; Mn, 0.38, and Mg, 0.26 per cent.; modified by the Pacz method. Next came the Italian exchange Paper on the "Use of Gamma Rays for the Radiography of Light-alloy Castings," by Mr. Marco Robbo. This was followed by a long Paper on the "Elimination of Aluminium from Tin Bronzes," by Mr. G. Blanc and Mr. Pierre

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Julien Le Thomas. The results were quoted of experiments using manganese dioxide, pure and diluted; potassium nitrate, again both pure and adulterated and a mixture of oxidizing agents. Energetic stirring is essential and figures are given as to the time necessary for maximum effectiveness.

The last Paper, by Mr. Bernard Faure, was essentially practical and showed step by step the making of a cast double-sided patternplate. Moreover, his explanation was simplified by the showing of an extremely well-produced coloured film. It is a film which the makers of stove-grate castings in this country should certainly see. During the afternoon, there was a visit to an up-to-date coke-oven plant.

[Preprints of many of these Papers are available and can be loaned individually to interested United Kingdom readers on request to the Editor of this JOURNAL, 49, Wellington Street, London, W.C.2. All are written in French.]

Plant Engineers to Set Up Fuel Committee

At the national conference of the Incorporated Plant Engineers, held at Harrogate recently, unanimous consent was given to a proposal that the Institution should set up its own national fuel policy committee. The proposal was made by Mr. L. G. Northcroft, chairman of the education committee of the I.P.E. In the matter of fuel policy, said Mr. Northcroft, there was a point where operational efficiency "comes to a dead end, due to some outside influence." Outside the efforts of the individual fuel user to establish a higher all-round standard of industrial fuel efficiency, there had seemed to be "a mass of passive obstruction" in the way of a properly co-ordinated policy for fuel utilization.

The views of the users of fuel and power were heard far less than the views of the suppliers of fuel and power. The Incorporated Plant Engineers, representing the technical users of fuel and power in industrial production and services, had the competence to offer views and recommendations on fuel policy to the Government and to any advisory bodies set up by the Government.

That could be done, to the greater benefit and welfare of the community, through a national fuel policy committee of the I.P.E., the members of which were the key administrators and executives responsible for keeping the wheels of industry turning.

New Foundry Magazine

Yugoslavia is the latest country to produce a bulletin covering foundry practice. It is published by the Institute of Mechanical Technology of Serbia, 8 rue Vele Nigrinove, Belgrade. It is a presumption on our part to assume this, but it is based on the fact that of the seven papers included, four are purely "foundry" and the others on allied subjects. The bulletin is printed in Russian and reliance has been placed on the short abstracts printed in English. French and German to gain knowledge of its contents.

INGALL, PARSONS, CLIVE & COMPANY, LIMITED—Mr. W. A. Purves has been appointed chairman in succession to the late Sir Martin J. Melvin.

Japanese Iron and Steel Output

Steel output in Japan during 1952 is scheduled at 4,600,000 tons, of which 1,600,000 tons will be for export, according to the Government's plan based on a draft made by the Economic Stabilization Board. In Japanese steel industry circles, however, the belief is held that, taking into account U.S. buying, exports will exceed the stated amount and that home production will be greater than the E.S.B. target.

Japanese steel exports increased appreciably in the closing months of last year, as may be seen from the following details announced by the Ministry of International Trade and Industry :—September, 140,000 tons; October, 190,000 tons; November, 223,000 tons; December, 221,000 tons. A total of $292,000,000 was earned by exports of steel during 1951, compared with $94,000,000 in the previous year.

Towards the end of last year, three large Japanese undertakings received inquiries concerning their capacity to export their products to the United States; the following quantities were given in reply :—Yawata Iron & Steel Company, 600,000 tons; Fuji Iron & Steel Company, 400,000 tons; Nippon Steel Pipe Company, 140,000 tons. Nippon has also disclosed that it has an extra capacity of 140,000 tons for shipment to Britain.

Japanese pig-iron production in March was 307,085 metric tons. Production of ingot steel totalled 616,598 metric tons, an increase of 8 per cent. on the February output.

For the fiscal year April, 1951-March, 1952, pig-iron production was 3,550,000 metric tons, against 2,433,150 metric tons in the previous fiscal year. Output of crude steel totalled 6,760,000 metric tons, compared with 5,297,041 metric tons.

Orinoco Ore

Plans for the construction of the new iron-ore port at Puerto Ordaz, on the Orinoco River, are now complete. The Orinoco Mining Company, a subsidiary of the United States Steel Corporation, which has undertaken to build this new town, has made an initial purchase from a national cement plant, Compania Anonima Venezolana de Cementos, a first step in the declared policy of the Company to obtain supplies in Venezuela.

The iron-ore deposits on Cerro Bolivar are in the form of a cap covering the summit of the hill, the amount of exportable ore being estimated at 400,000,000 tons. Shipment of the ore, which contains 63 per cent. of iron, will commence in 1953, and output will be increased from an initial figure of 5,000,000 tons per annum to a maximum of 10,000,000 tons in 1955.

U.S. Steel Plant for Brazil

Final arrangements have been made with the Export and Import Bank for a loan of U.S. $25,000,000 to the National Steel Works at Volta Redonda in Brazil and orders have already been placed in the United States for a second blast-furnace, 21 coke-ovens, two steel furnaces, and other equipment. It is hoped to increase steel production by 280,000 tons per year, making approximately 745,000 tons per year in all.

A new sub-committee of the Commission for Industrial Development is devoting attention to the creation of an automobile industry in Brazil; proposals have been studied from United Kingdom, United States, French, German, and Italian manufacturers.

Conference Works Visits

Foundries in the Sheffield Area to be inspected by the Institute of British Foundrymen on Friday, June 13

(*Continued from page 577*)

SAND FOUNDRY OF SHEEPBRIDGE EQUIPMENT, LIMITED

The name of Sheepbridge has always been connected with the production of castings in a wide variety of alloy irons, and this tradition still holds, although an entirely new building now houses the foundry. Irons of all known grades of tensile strength are produced, together with many special heat-resisting, corrosion-resisting and wear-resisting irons. The new sand foundry which the visitors will inspect particularly is laid out to handle these materials and to produce a very wide range of castings. The melting equipment consists of a number of cupolas of various sizes and a Stein oil-fired rotary furnace, though this plant is now being added to.

Two mechanized conveyor systems are installed. One embodies a continuous pallet-conveyor working in conjunction with four, pin-lift moulding machines, and the other is a batch-type, gravity, roller conveyor system working in conjunction with a variety of different machines of the pin-lift and turn-over types. A feature of the latter plant is the ability to store a fairly large number of moulds to permit of building up a sufficient quantity for casting in the correct grade of iron during a comparatively short period of the day. These two systems together confer the flexibility needed for the efficient handling of a large variety of castings.

The mechanized plant makes use of a synthetic sand. Hot sand from the knock-out positions is carried on a 300-ft. length of belt (partly for cooling purposes) and over a magnetic separator before returning to storage bins. From these it is fed as required to batch-type mixers and then returned to the moulding machines, continuous control being kept on its properties. The other section of the foundry deals with jobbing work and generally handles castings up to about five tons in weight. This section has its own plant for treatment of the natural sand employed, and additionally much dry-sand and some loam-sand moulding is practised.

Also included in the same building are the coreshop, fettling-shop and a well-equipped patternshop for metal and wooden patterns. The building is so designed that, if required, the space occupied by these ancillary departments could easily be added to the foundry proper and the service departments transferred elsewhere. Most of the handling of materials is mechanized and there are ample crane facilities. The coreshop is operated with 90 per cent. female labour. Core-sand is dried outside the building, delivered overhead to the batch mixer and thence (again overhead) to the benches or core-blowers. The "green" cores are carried by pendulum-type conveyors to vertical drying stoves.

The amenities block includes larger locker rooms (all personal lockers are heated and ventilated), showers and washing facilities. Amongst the specialized items in regular production in these foundries are chilled camshafts for many of the leading engine builders, flywheels, brake-drums, castings to feed the engineering sections of the Sheepbridge Group, and separator castings.

BRIGHTSIDE FOUNDRY & ENGINEERING COMPANY, LIMITED

Situated at Ecclesfield, a mile or so outside the Sheffield city boundary and on the main road to Barnsley, are the head offices and works of the Brightside Foundry & Engineering Company, Limited (Fig. 9). The Company is divided into three main divisions, foundry, engineering, and heating and air-treatment; the latter comprising eleven branches situated throughout the country and specializing in industrial heating, ventilation, dust-control and the installation of pit-head baths, washing and locker facilities, also heavy-duty cooking equipment for canteens.

The activities of the engineering and foundry division are concentrated at Ecclesfield and at Newhall Works, in the east-end of the city. Main products of these two divisions include hot- and cold-rolling mill plant; steelworks and non-ferrous plant auxiliaries; cold rolls for ferrous and non-ferrous rolling; hollow and solid rolls for numerous industries; ingot moulds; hammer blocks up to 150 tons finished weight; as well as "Hitest" and alloy castings for engineering purposes. In general, all castings up to 60 tons weight are manufactured at the Ecclesfield works, with the exception of rolls and alloy irons. The foundry also supplies adjoining engineering shops with iron castings.

Foundry

The foundry proper consists of a main moulding bay catering for castings up to 10 tons capacity, an adjacent bay for the manufacture of ingot-moulds and a "heavy" department, where large castings up to 60 tons capacity are manufactured. The whole of the foundry is served by four cupola furnaces, two of a capacity of 14 to 15 tons per hr., one of 10 tons and one of 4 tons. Additional plant includes two sand-mixing stations and a Sandslinger. Patternshop and fettling bays are adjacent to the main foundry.

Engineering

The engineering department consists of one large building divided into three main bays and houses under one roof the machining section, fitting and assembly section, blacksmiths, welders, stores and tool-room departments. The wide range of machinery used in the engineering department is capable

FIG. 9.—*Aerial View of the Eccles-field Works and Head Office of Brightside Foundry & Engineering Company, Limited.*

of machining castings up to 60 tons capacity and of milling surfaces up to 10 by 22 ft. The engineering department at Newhall deals mainly with specialized machinery for roll manufacture only, and the foundry department at the same works caters for heavy castings up to 150 tons finished weight, as already mentioned.

The Company has two subsidiaries, Moorwoods, Limited, of Sheffield (manufacturers of heavy-duty cooking apparatus suitable for canteens, domestic heating and cooking equipment and repetition grey-iron castings) and Buckley & Taylor, Limited, of Oldham (engineers, also manufacturing marine and land evaporating and distilling plant, surface condensers and industrial oil-coolers).

NEWTON CHAMBERS & COMPANY, LIMITED

Newton Chambers & Company, Limited, are to-day operating as constructional engineers, foundry engineers, and chemicals manufacturers. Although they no longer mine iron or coal, their operations are still based on the by-products of those minerals. On the engineering side, they are producing heavy industrial plant for the gas and carbonizing industries, for steel works, for chemical works and for structural engineering generally. In addition, they are producing on a mechanized scale, light castings for heating, housing, and catering. Ancillary to their production of heavy industrial plant of the container class ranging from steel slag-ladles to brewery vats, they have a specialized plant for lithcote-lining of vessels dealing with food, drink, and chemicals. Linked with their constructional plant is a factory for the production of tractored vehicles, more particularly excavators, cranes, booms, jibs and machinery of the earth-moving class. Coal distillates are processed at their chemical works and passed to a factory designed on the most modern architectural principles where a very large business in medicated paper and disinfectants is carried on.

Historical

Although the nationalization of the colliery industry separated them from a great deal of activity amounting to nearly half their total industrial investment, there are still employed over 4,000 people in the Thorncliffe valley works. To that valley nearly 160 years ago came two pioneers, George Newton, a Darlington man, and Thomas Chambers, born near Rotherham; these two men having obtained a lease of the minerals from the Earl Fitzwillian of that day, planted the seeds of this great enterprise. To-day, both on the management and the operative side of the industry there are direct descendants of the men who under the direction of Newton Chambers opened up the valley, dug the pits for iron and coal, erected the sheds, the furnaces, the shops, and the machinery.

Very early in the history of the firm those pioneers, Newton and Chambers, realized the significance of the invention of gas-lighting by William Murdock and after studying his invention they reorganized their foundry in order to build the equipment necessary for the lighting of towns and villages in England and abroad. They had a very important part in the great gasworks activity consequent upon Murdock's invention and by 1850 had been closely concerned with the erection of gasworks plants at hundreds of points in Great Britain. In the following twenty years, they began to export gasworks plant to many parts of the world. They sent out a complete plant to Buenos Aires and were represented at the southernmost civilized point of New Zealand. During the first world war their chief contributions were the supply of chemicals; (indeed this service dated back to the South African war) and of shell forgings, three bays of their foundry being allotted to the production of these, almost entirely by women. As a curious parallel, in the second world war, after the last of seven blast-furnaces had been taken down, a welding shop was fitted for the fabrication, welding, and assembly of ship sections (seventy miles from the sea) and this war work was very largely carried out by women. At the same time, in the constructional shop and in a factory erected for the construction of excavators, over 1,100 "Churchill" tanks were fabricated, fitted and assembled. Since the war Newton Chambers have been mainly concerned with heavy industrial plant, static and mobile, and with the processing of coal chemicals.

Model Training Scheme

Of the 4,000 persons employed in Newton Chambers's enterprise to-day about a third have, during the last ten years, been passed through the processes of training and education inaugurated for the Company by its managing director, Sir Harold West. Foundry amenities have been well catered for and

Conference Works Visits.

Fig. 10 shows new buildings for this purpose opened earlier this year. The Thorncliffe system of training is widely known because of a series of interesting, and indeed daring, experiments undertaken by a man whose primary interest has been the development of awareness in youth of its purpose, function and dignity in the social scheme. The "Thorncliffe Experiment" has been very well explained by Sir Harold West in a Paper which he delivered to the Royal Society of Arts in March, 1950. The general idea of life and work and service at Thorncliffe has been well summarized by Sir Harold in a phrase used by him on a special occasion to describe the "grand design" of industry. He said "What is the first, final and permanent objective of industry? What is its grand design? It is the object of all life to perpetuate itself. That is the purpose of industry; to continue in being, to maintain employment, to provide life and living for the greatest possible number: to feed and strengthen communities of people. How is that to be done? By healthy, sturdy, efficient service of men and women, who understand and believe in what they are doing. Business, to continue, must be remunerative. That is a condition of survival. A business which consistently loses money will wither and die, with all who depend upon it. The primary object of industry, therefore, is to co-operate for the prosperity and continuity of trade, contributing by hand and brain every required form of skill and energy. That is a worth-while objective, a lasting incentive for any enlightened, civilized and progressive community."

OSBORN FOUNDRY & ENGINEERING COMPANY, LIMITED

As several accounts* have appeared quite recently in the JOURNAL describing the Osborn foundry and the latest mechanization and improvements, it is not proposed to duplicate the details of the layout in this context.

A simplified description of the plant is that there is a large shop for heavy steel castings, a new shop for repetition castings, and a third for the alloyed type. It is interesting to note that the new mechanized shop was erected on a roadway running parallel with the heavy foundry, and that apart from the steelwork and roofing, the whole of the construction has been designed and carried out by the firm's own staff. A gas-fired furnace for preheating the charges for a "low" high-frequency melting furnace has recently been installed. This increased production, and lowered melting costs. Melting is also carried out both by the arc-type electric furnace and the converter process. The plant for this latter process, of course, includes cupola melting and the desulphurization of the liquid iron. Two installations of outstanding importance to the foundry have been the new mechanized moulding plant, and the integrated mechanized sand system which supplies this plant in addition to other sections.

* Osborn's Steelfoundry Extension by J. Preston, July 12, 1951, p. 41; Osborn Apprentice Scheme, June 10, 1948, p. 561.

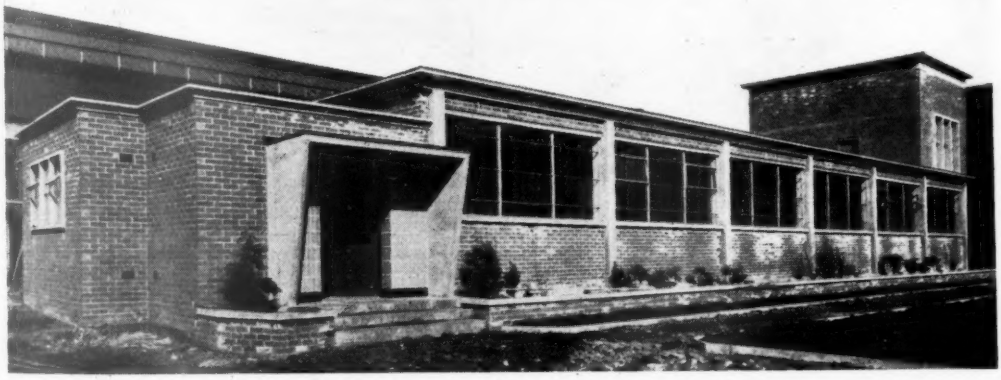


FIG. 10.—*General View of the Foundry Baths opened by the Rt. Hon. Sir Walter Monckton, Minister of Labour and National Service, on April 4 this year.*

DURING THE WEEK in which the Conference of the Institute of British Foundrymen is being held in Buxton, arrangements have been made to include in the ordinary programme of the Spa Cinema, Buxton, a film, "Lloyds Nowadays," the most recent pictorial description of the steel foundry of F. H. Lloyd & Son, Limited, of Wednesbury.

"OPEN HOUSE" at the Erdington (Birmingham) works of the Aston Chain & Hook Company, Limited, on Saturday morning created so much interest among relatives and friends of employees that the occasion will probably be repeated annually. Although normally a five-days week is worked, volunteers manned machines so that visitors were given a clear picture of everyday production activity.

International Meehanite Research Institute

Conference at Harrogate

The twentieth annual conference of the International Meehanite Research Institute was held at the Hotel Majestic, Harrogate, from May 20 to May 22. Representatives, who numbered nearly a hundred, included many European members and the subjects discussed covered a wide range of ironfoundry activities. The conference opened under the presidency of Mr. Henry Gardner, of Glenfield & Kennedy Limited, who welcomed new members and in his opening address stressed the importance of research and the value of the Institute to members. The preliminary business session included reports from the secretary, Mr. E. W. Harding and the treasurer, Mr. J. D. Carmichael, O.B.E., J.P.

The chairmen of the various committees then gave an account of their work during the year. The chairman of the technical committee, Mr. E. Walker, reported on the past year's research activities and the numerous ideas for new work. The secretary referred to the very successful foremen and metallurgists' conference held at Stockton-on-Tees last October and the visit to Ashmore, Benson, Pease & Company, as well as mentioning the Italian and Scandinavian branch conferences, held during the year. The satisfactory progress of the Meehanite Apprentice Training School at the Butterley Company's works at Ripley, near Derby, was reported on by the chairman of the educational and training group, Mr. G. B. Taylor. Acknowledgement was made of the fine work of the instructor and the valuable support given by the directors of the Butterley Company to the school. Three of the apprentices who had gained the leading places during the year's course were invited to attend the conference as a reward for their aptitude and keenness.

Technical Session

The technical session then opened under the chairmanship of Mr. E. M. Currie. Subjects listed for discussion included "Mechanical Properties of Meehanite at Elevated Temperatures," "Experiences with Water-cooled Cupolas," "Machinability and Tool Wear," "Foundry Economies and Ideas," "Casting Service Records" (from all licensees), "Flame Hardening," "Cupola Dust Control," etc. In the management session, Papers were presented by Mr. H. Gardner on "An Introduction to Work Study" and by Mr. E. K. Gould on "Productivity in a Mechanized Foundry." In addition, a foundry and metallurgical session was held, with Mr. G. B. Taylor in the chair, at which reports were discussed on such subjects as "Cement-sand Moulding," "Wear-resistance of Meehanite," "Thermo-setting Resins in Coremaking," "Improvement of Feeder Efficiencies," "Cupola Basic Linings," "Carbon Control and Coke Tests," "Bonding Clays," "Tuyere Air Velocities," "Magnetic and Electrical Properties of Meehanite," "Section Size and Mechanical Properties," and the like.

The annual dinner was held on the evening of the first day, presided over by Mr. John Cameron snr., who welcomed the members and gave an interesting account of the history of the Institute. A toast to Mr. Cameron on his remarkable vitality on the eve of his eighty-third birthday was proposed and received with acclamation. The toast to the Research Institute

(*Continued at the foot of col.* 2)

was proposed by Mr. John Cameron jnr. and responded to by Mr. H. Gardner. The conference concluded with a visit to the foundries of J. Blakeborough & Sons Limited, Brighouse, Yorkshire. Points of special interest noted by the visitors included the operation of the water-cooled cupola, fettling-shop layout and equipment, storage hoppers with indicators, a centrifugal casting machine and basic ladle-linings.

British Standards Institution

Standard for Temperature Chart Ranges

A new British Standard for chart ranges for temperature-recording instruments (B.S. 1794:1952) has recently been issued. It makes recommendations for the temperature ranges of charts used in recording instruments actuated by: gas-expansion, mercury-in-steel, platinum/rhodium-platinum thermocouple, resistance thermometer, and radiation pyrometer. As the preferred ranges have been compiled from data supplied by many instrument manufacturers, their calculation has been achieved by grouping and consolidating the ranges favoured by individual users. Where minor differences in starting point and range were encountered during compilation they were embodied, wherever possible, in one range containing their maximum and minimum temperatures. There are in use many preferred ranges peculiar to a particular industry or process, and these have been included in the ranges specified in this standard. In most cases these special ranges have developed from the need to provide openness of scale at important temperatures, and their use requires some special arrangement of the measuring system in order to provide the necessary sensitivity.

Although these chart ranges embrace the whole of the useful temperature scale it is appreciated that not every instrument manufacturer will be in a position to adopt them in their entirety, especially since some of them are for use in conjunction with particular types of measuring systems. Further, the use of the whole of such a comprehensive selection of ranges is unnecessary when instruments are manufactured for a particular section of industry. Copies of this standard may be obtained from the Institution, sales branch, 24, Victoria Street, London, S.W.1 (price 2s).

New Standard for Cast-aluminium Hollow-ware

A new British Standard for cast-aluminium saucepans and frying pans for domestic use (B.S. 1859:1952) has been prepared as a result of a request received from the Women's Advisory Council on Solid Fuel. The specification applies only to aluminium saucepans and frying pans produced by casting. It is confined to domestic utensils and does not cover the larger type of utensil used in canteens and hotels. The standard is mainly concerned with ensuring that satisfactory materials are used both for the body of the vessel and for the insulation of the handles. Aspects of design have not been covered except where necessary to ensure satisfactory performance in service. Neither has there been any attempt to establish a range of standard sizes of saucepans or frying pans. The saucepans are however required to be marked with their capacity, and a thermal-insulation test for the handles of saucepans has been included. General requirements include composition of metal, workmanship and finish, and marking. Copies may be obtained from the British Standards Institution, sales branch, 24, Victoria Street, London, S.W.1 (price 2s).

Process Control of Cast Iron for Vitreous Enamelling*

By J. Bernstein, A.R.I.C., A.C.T. (Birm.), A.I.M.

The vitreous enamelling of cast iron has been carried out in some form or another for a considerable number of years as a means of protection of the iron against corrosion and also for the purpose of providing a durable and decorative finish. . These two major properties of vitreous enamel are still widely sought. Indeed, advantage of them is taken in the wider application of this type of finish, typical examples being the lining of chemical-engineering equipment and liquid-food containers with special forms of glass. With all forms of protective coatings, numerous problems may be encountered in the obtaining of a perfectly continuous and strongly adhesive protective layer. The application of vitreous enamel to cast iron is no exception.

As in most industries, in the last 25 years there have been considerable improvements in the iron-founding industry and this has materialized in the control of the quality of the castings, increases in output and modifications to the structure and mechanical properties of cast irons. Cast iron has found increasing application as an industrial and engineering material and engineers are beginning now to appreciate that, if the properties they desire are specified, their requirements can in most cases be satisfied by the use of the appropriate type of iron *e.g.*, malleable iron, nodular iron, ordinary grey cast iron, high-duty alloyed grey cast iron or chilled cast iron. Similarly, can the producers of vitreous enamel finishes claim that the more stringent demands of the domestic and industrial markets are being met with most satisfactory and encouraging results. It would be idle to deny that the more particular the demand as to quality, for whatever the application of the product, the greater the care that must be taken during the manufacture and processing. The higher the standard set, the task of the producer is proportionately made more difficult. In these circumstances it is understandable that a greater quantity of products must be put aside as being below standard or classified in this particular industry as "rejects." It would be inconsistent to expect otherwise. Why is it, then, that because rejects are met in daily production, statements are made to the effect that cast iron to-day is not as good for vitreous enamelling as that made many years ago?

It is the Author's opinion that such statements are misleading and that the problem of rejects met in the vitreous enamelling of cast iron to-day is primarily due to the very high standard of performance and appearance demanded. Technical control and development in vitreous enamelling are increasing, and, in general, are tending to keep abreast with the technical developments and control in the manufacture of cast iron which is to be enamelled, but there is much yet to be learned and much of what is already known still remains to be applied.

If the enameller were asked to prescribe his requirements in the castings he is to process, he would most likely call for clean castings of even thickness, free from porosity, blowholes and sand or slag inclusions, and castings that will not warp or crack. The enameller will often add to his list of requirements the rider that he requires castings that can be enamelled!

The notes which follow are based on some experiences in the production of iron castings for wet-process vitreous enamelling, the products being designed for domestic and industrial applications.

FOUNDRY

Design and General Equipment

It is particularly true that good workmanship is incompatible with dirt and untidiness, and the first essential for the efficient production of high-quality iron castings is an orderly foundry. At this stage, it should be emphasized that black moulding sand in use is not "dirt," but that dried powdery moulding sand on the working parts of machines, in gangways, in the patternshop and dressing-shops can most decidedly be classified as unnecessary "dirt." Before starting to produce castings for vitreous enamelling, and these *must* be high-quality castings, the foundry should be tidied. This is most easily possible and, indeed, more important in mechanized foundries, where, in general, the individual is not as skilled a foundryman as his counterpart in jobbing foundries.

The design of castings for vitreous enamelling is an important feature and care should be taken to ensure, as far as is possible, that the section thickness of the castings will be uniform. Where changes in section are necessary, for extra mechanical strength, for the drilling or tapping of holes, for assembly of the individual castings into a complete unit or purely from a weight aspect, these changes should be gradual. Apart from the difficulty of enamelling large bosses on an otherwise thin-section casting, there will be a tendency for "drawing" in the castings and a coarser structure will be found in the thicker sections. The depth of penetration of

* Paper presented to the Spring meeting of the Institute of Vitreous Enamellers at Southport. The Author, who is attached to the Simplex Electric Company, Limited, submitted this Paper as a communication from the Institute of British Foundrymen.

"drawing" in castings can only be determined by destruction of the castings or by use of gamma- or X-rays. As few foundries apply the X-ray technique, it is quite general to allow the castings to pass inspection rather than be scrapped, thus leaving a potential reject for the enamelling-shop personnel, who will, no doubt, try to fill the surface draw but cannot fill the deeper cavities. Sharp corners, concave or convex, for several reasons should be avoided in the design of the castings, among which the following may be included:—

(1) Sharp-cornered projections on a mould surface permit the drying of the sand at the extreme edge, with consequent powdering. During casting these dry-sand grains tend to wash into the mould.

(2) Sharp projections may be washed away in the "green" state, during rapid pouring.

(3) Deep and sharp-cornered crevices in a mould (*e.g.*, fastening lugs on the casting) may be a source of turbulence in the flowing iron and any floating contamination in the iron may remain close to that point when the casting is solid. Even though a mould be cast successfully, sharp projections may easily break off during handling of the castings and even if the sharp corners exist and remain, the enamel tends to flow away from the extreme edge during fusion or, alternatively, will chip off in the cold state.

The ideal to aim for in designing a casting for vitreous enamelling should be smooth lines and round corners, even sections, rigidity, and the possibility of inducing streamline flow in the mould during pouring. A further and equally important advantage in a design conforming roughly as indicated will be the chance of avoiding excessive internal stresses. It is unlikely that the castings will be completely free from stresses under normal production conditions, but attention to the points mentioned will reduce to a minimum some of the cracking and warping that occurs during enamelling.

Pattern Equipment and Box-parts

Whether the castings are produced on the floor or by machine-moulding, the next factors to receive attention before starting production are the pattern equipment and moulding boxes. The patterns may be in brass, aluminium or iron; each has its advantages, but, whatever the material, the pattern should be cleaned each day before work commences and polished with fine plumbago and a dry cloth, all excess plumbago being blown off. The plumbago will help to keep smooth the pattern surface. If a tendency for an excess of plumbago should occur after a few days, the patterns should be cleaned down with paraffin, rubbed dry, and treated freshly with plumbago. Where patterns are heated, as in machine moulding, great care should be exercised in regulating the temperature to avoid drying the sand and the heaters should be arranged in such a manner that uniform heating of the pattern is obtained. A correctly-polished and heated pattern requires no parting medium if sand conditions are correct.

Under the heading of pattern equipment, moulding box-parts can be included, for the obvious reason of ensuring that there is sufficient room in the boxes for the use of the best running and gating system, without altering the position of bars in the boxes. The depth of the boxes and bars should be studied, so that uniform ramming can be obtained. At least one inch of sand should separate the mould surface and the bottom of the bars, which should be tapered to a point or be of the saw-tooth type. The bars should be roughened to give the sand adequate support and prevent the movement of squares of the mould during filling with liquid iron. The boxes should be sufficiently rigid to withstand the pressure of moulding machines without movement on lifting off. While these facts are commonplace in all foundry practice, they are mentioned here because the slight changes in shape of the castings which may result from movement of the mould or parts of the mould may be exaggerated when flat surfaces are enamelled. The resulting uneven reflection of light on the glossy enamelled surface gives dark lines or patches which appear to exaggerate the defect. Similarly, where the mould has not been correctly rammed, under the bars of the box, or where ramming at these points is too hard, it is possible to plot on the enamelled casting the position of the bars without previously having seen the moulding box. In the case of ramming under the bars being inadequate, soft spots occur in the mould with a consequent slight thickening of the casting along the direction of the bars. Where excessive ramming takes place beneath the bars, due to hand tucking followed by the squeeze of the moulding machine, the outline of the bars can be observed on the enamelled castings in the form of a slight surface concavity. Examination of the castings in the as-cast condition will hardly reveal this defect and, even where a straight edge is applied to the surface, it is likely that the most particular inspector would pass the castings as satisfactory. Such slight surface disturbances are best detected by feeling with the fingertips. When such castings are shot-blasted the uneven state of the surface is slightly worsened, due to the uneven rebound of the shot from the surface, causing secondary impacts on those surfaces not parallel to the plane of the casting.

Moulding

Differences in experience with natural and synthetic sands results in the existence of divergent opinions, but it is the Author's experience that either type of sand will do the required job satisfactorily. An advantage of synthetic sand is the ease with which its permeability and green-sand properties may be controlled, but, with care, consistent results can be obtained with natural-bonded sands although the permeability of the latter is less easily varied at will. For machine or floor moulding, similar sand-properties may be required, but this is not always so, as some experiments described later will indicate. Facing sands of high

green-strength and permeability, in conjunction with low moisture and coal-dust contents, generally are found to be most satisfactory. The low moisture content and high green-strength permit the minimum use of parting media, which may be found to be more necessary in floor-moulding, where it is not possible to warm the patterns. Patent sprays, paraffin, plumbago or parting dust appear to make little difference to the enamelling of the castings. In machine moulding on a mechanized plant, the use of cool sand is essential and the patterns should be kept sufficiently warm to prevent condensation of moisture without risk of drying the sand at the surface of the mould. If a warm sand is used, the patterns need to be warmer still to avoid condensation of water from the sand and further, a warm sand is more likely to air-dry at the surface. Castings which will enamel satisfactorily can be made with a single-purpose sand, but it is claimed that consistently good enamelling results are best obtained by the use of separate facing sand and backing sand, the backing sand being weaker than the facing sand. Laboratory control of the sand-preparation is recommended to ensure consistency during the day and from day to day. The quality of the backing sand, while not as important as the facing sand, is nevertheless of some consequence, as the latter consists of approximately 75 per cent. of backing sand. If the green-strength of the facing sand tends to fall below standard, new (red) sand should be added and the time of milling checked. The use of a separate clay addition, although most likely to raise the green-strength of the sand, will also tend to reduce its permeability to the detriment of the castings. It is recommended that in mechanized plants as much as possible of the "fines" is continuously extracted from the backing sand, the properties of which will normally be maintained by the amount of spilled or unburned facing sand returned to the sand-preparation unit. Again, should the sand properties fall below standard, an addition of new sand should be made. A convenient point for making this addition in most plants is at the knock-out.

Sands

All foundries have their own particular standards which may vary, and yet give equally good results. Two examples of this may be quoted. In one case, a frame casting of small surface-area and weighing 25 lb. made on the floor in natural sand gave the same results on enamelling as the same castings machine-moulded in natural sand. The properties of the two sands were as given in Table I.

It was not possible to make good moulds on the machine with the sand used on the floor and no apparent improvement in the castings was obtained when the floor moulder used the sand from the mechanized plant. Thus, apart from the actual green-sand properties, the technique of moulding has an influence on the quality of the castings.

In a second example, the results of enamelling castings having a relatively large surface area and weighing 15 lb. each were compared, some of the castings being machine-moulded in natural sand and others in synthetic sand. The enamel-shop rejects were almost identical in the two cases; in both tests, the results were assessed on hundreds of castings enamelled under the same conditions in acid-resisting enamel applied without a ground-coat.

TABLE I.—*Sands for Floor-moulding and Machine-moulding.*

Facing Sand.	Floor moulded.	Machine moulded.
Green-compression strength, lb. per sq. in.	8.4	12.2
Permeability (A.F.S.)	28	36
Moisture content, per cent.	5.2	4.5
Coal-dust content, per cent.	6.3	3.9
Backing Sand.		
Green-compression strength, lb. per sq. in.	7.9	11.1
Permeability (A.F.S.)	44	32
Moisture content, per cent.	5.3	5.8
Coal-dust content, per cent.	3.8	5.4

The use of coal-dust in moulding sand for castings to be enamelled has provoked opinions both for and against. Experiments carried out indicate that sufficient coal-dust should be used to provide the best possible casting. An optimum percentage cannot be given as a general rule, as sand and metal conditions vary so much from foundry to foundry, but the Author aims at coal-dust contents between 4 and 5 per cent. Wood-flour and pelletted pitch were used experimentally in varying quantities either as a proportional or complete substitute for coal-dust without any noticeable advantage. The use of a very small amount of coal-dust in moulding sand results in rougher castings and stronger sand adhesion but does not appear to affect the enamelling results. Indeed, it is often found that, where large, flat surfaces are to be enamelled, the less the coal-dust in the sand the better are the castings. In certain castings, where thick bosses occur adjacent to a thin section, "drawing" results if red sand is not placed as a chill on the areas in question. Such areas are likely to give trouble during enamelling, not due to the use of red sand, *per se*, but due to the fact that the position of the "drawing" is moved from the surface to a position below the surface of the casting.

Position of Surfaces to be Enamelled

Further experiments carried out to compare the behaviour during enamelling of castings made in different ways indicated that no recommendation could be made as to whether castings for vitreous enamelling should be made with the surface of the castings to be enamelled uppermost or the reverse. This statement is based on the results of enamelling thousands of castings. Duplicate patterns of the two castings mentioned earlier being available, one of each type was turned over. In the case of the castings made with the face to be enamelled downwards, the foundry rejects tended to be a shade higher than when the face to be enamelled was uppermost during casting and at first the enamelling results were in favour of these castings thus justifying—from the cost point of view—additional rejection at the foundry. However, after a few

weeks, the enamelling results showed no difference between the two methods of casting and, at the time of writing, the results from each type of casting are comparable whichever way they are made.

The increase in foundry rejects was mainly due to " drawing " in the vicinity of section changes. The tendency for drawing existed more or less consistently, but occurred on the surface of the casting which was at the bottom of the mould so that when the castings were made face uppermost, the " drawing " defect occurred on the back of the castings and was therefore not a cause for rejection, whereas when " drawing " was observed on the face to be enamelled the castings were scrapped.

It is claimed by some that the correct method of making castings for enamelling is " face downwards," in order to permit any contaminating element in the iron to work itself to the top of the mould, *i.e.*, the back of the casting, but, with correct sand preparation, clean patterns and efficient gating, there should be no contamination of the iron.

Moulders' Skill

It should not be overlooked, when comparing moulding methods, that in general a skilled floor-moulder knows the best conditions for his castings and he is careful to avoid loose sand in the mould. A machine-moulder requires stricter supervision to ensure that the moulds are made as directed. All the care and attention given to providing the machine-moulder with the best equipment and materials should not be wasted by lax supervision during moulding. Piecework operators tend to speed up their own performance after the standard of moulding has been set. Provided that no operation is omitted there can be no objection, but it is very easy for the machine-moulder to close a mould which has not been blown clean. Without close attention, the moulders may occasionally blow their patterns clean while the mould is open, *i.e.*, before the top half of the mould is made. The loose sand from the pattern may then be deposited in this open mould. To assist in saving time, the moulders may also omit to blow the patterns clean before making further moulds. This operation must not be omitted.

Running and Gating

As with the properties of sand, it is not possible to specify the exact type of running and gating system to use for any particular casting. Different foundries prefer their own methods, but as long as clean iron is allowed to enter the moulds it does not really matter whether a spinner or other form of slag-trap is used. A trap of some sort to retain unskimmed slag and to check the first flow of iron from the ladle is essential. Long, thin ingates are to be preferred, as these too will help to prevent the entry of cinder into the moulds.

The effect of the interval between casting and knock-out on the results of enamelling light castings has received attention from the Author, who has not been able to confirm that the time of contact between the sand and hot castings has any measurable influence. Knocking-out of castings 13 min. after casting gave the same order of results on enamelling as on castings which were allowed to remain in the moulds overnight. Micro-examination of the edge structure of castings left in the moulds overnight revealed no differences from the surface structures of the castings knocked-out after a few minutes. Sulphur prints gave no evidence of a sulphur pick-up in the castings knocked-out 15 hrs. after casting.

When the mould is made on the floor, it is unlikely to be moved before pouring takes place, but in mechanized foundries the moulds may have to travel along roller-track or plate-conveyor. Whatever form of mould conveyor is employed, it must be ensured by frequent maintenance that vibration or shaking of the mould does not take place, as the sand may be loosened and bad castings result. A good precaution even on excellent conveyors is to reduce to a minimum the distance between the moulding and pouring stations.

(To be continued)

Institute of Vitreous Enamellers

Spring Conference at Southport

The annual Spring conference of the Institute of Vitreous Enamellers was held at the Prince of Wales Hotel, Southport, Lancs, on May 22 and 23. It was attended by some 100 members and their ladies and proved to be a very instructive and enjoyable occasion.

On the first day members went by coach to the works of the Richmond Gas Stove Company, Limited, at Warrington, Lancs, where facilities were provided for them by the Company to hold a technical session, at which Mr. H. W. Clewes (J. A. Jordan & Sons, Limited) presented a Paper on " Process Control of Vitreous Enamelling," after which a lively discussion ensued. Members were then entertained to luncheon by the Company and were afterwards conducted over the works where they were able to see the manufacture and enamelling of gas cookers. In the evening, a visit to the Garrick Theatre, Southport, was arranged.

The following morning, members were conveyed to the works of Stoves, Limited, at Rainhill, where they inspected the works and were subsequently entertained to luncheon by the hosts. The afternoon technical session at the works was devoted to two papers; an official contribution from the Institute of British Foundrymen on " Process Control of Cast Iron for Vitreous Enamelling " by J. Bernstein, and a contribution from the Sheet and Strip Metal Users' Technical Association by Dr. E. Marks on " Some Aspects of the Manufacture of Steel Sheets for Vitreous Enamelling." Once again, members joined in keen discussions, only curtailed by the amount of time available. The evening was devoted to an informal dinner/dance at the Prince of Wales Hotel, which provided a highly enjoyable and entertaining closing function.

Parliamentary

Expansion of D.S.I.R.

MR. ELLIS SMITH asked the Parliamentary Secretary to the Ministry of Works, as representing the Lord President of the Council (1) on what date proposals were made for the expansion of the Department of Scientific and Industrial Research; what were the answers made to the proposals; which had been carried out; and why had the others not been acted upon; (2) if he would make a full statement on the future of the D.S.I.R., and what steps were to be taken to bring about a great expansion of its work.

In reply, MR. A. H. E. MOLSON said that proposals for the expansion of D.S.I.R. were contained in the D.S.I.R. Report for 1947-48 (Cmd. 7761), and included the development of existing research stations, the creation of new facilities for research in hydraulics, mechanical engineering, and radio, the development of industrial research associations, and additional grants for fundamental research and for the training of research workers in universities. Subsequent annual reports, including the report for 1950-51 (Cmd. 8494),* had described the progress made towards this expansion.

Substantial progress had been made, he said, but where delays had occurred these were due to the difficulty of recruiting sufficient numbers of suitably qualified scientists and delays in the construction of new buildings.

Mr. Molson said that the Government fully supported the department's proposals and intended to implement them as quickly as circumstances allowed. Despite the recent cuts in Government expenditure, the vote to D.S.I.R. had not been reduced.

Government Loans for Fuel-saving Devices

In the House of Commons last Thursday the Minister of Fuel and Power gave details of the experimental Government loan scheme to encourage the installation of industrial-fuel-saving equipment. The scheme, which will be operated as an experiment, applies in approved cases to industrial firms able to save substantial amounts of fuel by installing any of a number of specified fuel-saving devices. These devices are back-pressure engines and turbines; waste-heat boilers; feed water economizers; air preheaters; heat exchangers; and structural insulation of single-sheeted factory roofs and walls.

The total amount available for loans will not exceed £1,000,000 and loans to individual firms will not exceed £25,000. Commercial rates of interest will be charged. Applications will be dealt with in order of the dates of receipt. An explanatory leaflet giving full details and an application form may be obtained from the Fuel Efficiency Branch, Ministry of Fuel and Power, Queen Anne's Chambers, Dean Farrar Street, London, S.W.1.

Replying to COLONEL RALPH CLARKE, who asked the Minister if he would make an announcement about the Government loan to encourage fuel efficiency in industry, MR. GEOFFREY LLOYD said: " This loan scheme is significant not only because the Government is experimenting in a new field by offering financial help to encourage fuel efficiency in industry, but also because it is in keeping with the general need for fuel saving at home to free more coal for export."

Losses on Non-ferrous Metals

In a question addressed to the Secretary for Overseas Trade, as representing the Chancellor of the Duchy of Lancaster, MR. NABARRO asked what losses were being incurred by his department in respect of falling world prices of non-ferrous metals, and when he proposed to denationalize dealings in these metals to enable British manufacturers to buy their supplies on a free market at world prices or lower.

MR. H. STRAUSS, who replied, said that the recent reductions in Ministry of Materials selling prices of zinc and lead as a result of the fall in world prices were involving losses. Since they were attributable in part to depreciation in the value of stocks as distinct from the writing off of the premium element in high-cost contracts made during the period of scarcity, the exact amount of the loss could not be determined until the stocks were actually sold.

It was the policy of the Government, he said, to return trading in non-ferrous metals to private hands as soon as the balance of payments permitted.

Fuel for Ironfoundries

Asked by MR. SWINGLER what was the purpose of sending form No. C.86/M/I.F. to firms which used only solid fuel, the allocation of which was fixed by the Ministry of Fuel and Power, MR. SANDYS said that the purpose of that form was primarily to obtain the information about fuel stocks, receipts, and consumption required by the Ministry of Supply and the Ministry of Fuel and Power for arranging the distribution of fuel supplies to ironfoundries.

MR. M. MACPHERSON asked how soon the Minister considered it would be possible for him to withdraw his request to the Minister of Fuel and Power to deliver coke to the ironfoundries on a lower scale than normal. In reply, MR. SANDYS pointed out that the request referred to was made by his predecessor nearly a year ago. He was afraid that the state of our coke supplies would not justify any change of policy.

Allocation of Hematite

Asked by MR. SWINGLER if he was now in a position to make a statement on the proposed allocation scheme for hematite pig-iron, MR. DUNCAN SANDYS, Minister of Supply, said that further examination of this matter had revealed considerable practical difficulties in introducing a separate licensing scheme. He was, therefore, examining alternative means of dealing with the problem.

* Extracts published in the May 15 issue of the JOURNAL.

Increasing Pig-iron Production

An important stage in the planned expansion of pig-iron and steel production was reached recently when Mrs. Chetwynd Talbot, wife of the chairman and managing director of the Cargo Fleet Iron Company, Limited, Middlesbrough, played the leading part in blowing in a new blast-furnace which is to replace an older stack of much smaller capacity.

The new furnace, which has taken 7½ years to build, has an estimated capacity of 3,500 to 4,000 tons a week —double the capacity of the furnace it replaces—and it is hoped that the coke consumption will be reduced from 22 to 17 cwts. per ton of pig-iron produced. Moreover, the extra output of pig-iron will enable the Company to bring into operation a 200-ton capacity steel furnace and it is hoped that this in turn will facilitate the gradual restoration of the cogging and light and heavy section mills to full operation.

Mr. Talbot revealed that at the West Hartlepool Works of the parent Company, the South Durham Steel & Iron Company, Limited, additional pig-iron and steel-making capacity, which is due shortly to come into production, promises to assist in further increasing the output of steel and the number of shifts worked in the plate and sheet mills. New blast-furnaces are also nearing completion at Consett and Skinningham in the north-east area, and both these are expected to come into production within the next few weeks.

Personal

MR. A. S. VALENTINE, director and chief electrical engineer of Balfour, Beatty & Company, Limited, is resigning for health reasons.

MR. WILLIAM HUGHES, foundry manager at a Tipton factory, a non-swimmer, dived into a canal on May 27 to rescue a six-year-old boy.

THE PRESIDENT of the Board of Trade has appointed MR. G. F. A. BURGESS, joint managing director of the British Metal Corporation, Limited, and chairman of the International Tin Research and Development Council, to be a part-time member of the National Film Finance Corporation.

THE MANAGERS of the Royal Institution have accepted the resignation of PROF. E. N. DE C. ANDRADE, F.R.S., from the offices of Director in the Royal Institution, resident Professor in the Institution, Fullerian Professor of Chemistry, Superintendent of the House, and Director of the Davy Faraday Research Laboratory.

MR. JOSEPH HOLLEWORTH, who has 68 yrs. continuous service with Lee & Hunter, Limited, machine tool manufacturers, of Crocus Street, Nottingham, was presented with a gift of £50 from the managing director, Mr. J. R. Lee. Mr. Holleworth was apprenticed to the firm in 1884, and although now in his 82nd year, still does a 40-hr. week on fine precision work.

MR. W. G. TUCKER, foundry superintendent, I.C.I. Limited, Metals Division, Witton, has been elected president of the Birmingham Metallurgical Society (Incorporated) for the ensuing year. The four vice-presidents who have been elected by the Council are: Mr. G. Parkin, Mr. H. Evans, Mr. J. O. Hitchcock and Dr. C. E. Homer. The honorary treasurer is Mr. A. C. Craig.

PRESIDENT of the British Cycle and Motor Cycle Manufacturers and Traders Union, MR. F. A. KIMBERLEY, was presented with gifts on May 30 to mark the completion of his 50 yrs. service with the James Cycle Company, Limited, Birmingham, of which he has been managing director since 1939 and a director for over 30 years. A picnic case from the workpeople was handed to him by Mr. F. Bartlam, who has been with the firm for 58 years.

MR. W. LINDSAY BURNS, who has been executive head of the Balfour Group of Companies for many years, was appointed chairman of Henry Balfour & Company, Limited, at the recent annual general meeting held at Leven, Fife. For some time he has been vice-chairman of Henry Balfour & Company, Limited, chairman of George Scott & Son (London) Limited, and Ernest Scott & Company, Limited, and vice-chairman of Enamelled Metal Products Corporation (1933) Limited.

MR. ROBERT W. ASQUITH, president of the Machine Tool Trades Association, left by air for Canada last Thursday to attend the Canadian International Trade Fair which opened in Toronto on Monday. MR. W. J. MORGAN, general manager of the association, is already in Canada, where he is in close touch with leading industrialists, many of whom will be visiting London in the autumn for the great International Machine Tool Exhibition to be held at Olympia from September 17 to October 4. British machine-tool manufacturers have participated on a large scale in the last two annual trade fairs in Toronto. Since the end of 1949 the order-book for the export of machine tools to Canada has risen in value from some £300,000 to over £3,000,000.

Increases of Capital

The following companies are among those which have recently announced details of capital increases:—

MAGNETIC & ELECTRICAL ALLOYS, LIMITED, London, W.1, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £50,000.

WILLIAMS BROS. (SHEFFIELD), LIMITED, brass-founders, increased by £15,000, in £1 ordinary shares, beyond the registered capital of £25,000.

P. I. CASTINGS (ALTRINCHAM), LIMITED, Altrincham (Ches), increased by £10,000, in £1 ordinary shares, beyond the registered capital of £10,000.

PRESTBURY ENGINEERING COMPANY, LIMITED, Prestbury (Glos), increased by £2,000, in £1 ordinary shares, beyond the registered capital of £4,000.

JOHN CASTLE & COMPANY, LIMITED, machinery and metal merchants, etc., of London, W.C.2, increased by £4,000, in £1 ordinary shares, beyond the registered capital of £1,000.

ASSOCIATED BRITISH ENGINEERING, LIMITED, London, S.W.1, increased by £200,000, in £1 6 per cent. cumulative preference shares, beyond the registered capital of £1,250,000.

KAYE & COMPANY (HUDDERSFIELD), LIMITED, manufacturers of high duty alloy castings, increased by £15,000, in £1 ordinary shares, beyond the registered capital of £10,000.

J. T. MEREDITH & COMPANY, LIMITED, general iron workers, of London, S.E.1, increased by £23,000, in 5,000 "A" and 18,000 "B" shares of £1 each, beyond the registered capital of £7,000.

BROOKES & COMPANY (1925), LIMITED, wire and iron workers, of Manchester, increased by £10,000, in £1 6 per cent. cumulative redeemable preference shares, beyond the registered capital of £3,000.

VALVES, LIMITED, general engineers, of Coventry, increased by £42,000, in £1 ordinary shares, beyond the registered capital of £8,000. Clifford Motor Components, Limited, holds nearly all issued shares.

TILTMAN LANGLEY LABORATORIES, LIMITED, research and development engineers, of Redhill (Surrey), increased by £20,000, in £1 ordinary shares, beyond the registered capital of £10,000.

LEE-MIDGLEY, WHITEHEAD & COMPANY, LIMITED, metal manufacturers and merchants, of London, W.C.2, increased by £3,000, in £1 ordinary shares, beyond the registered capital of £1,000.

BROOKS-FLETCHER, LIMITED, ironfounders, etc., of Walkden (Lancs), increased by £10,050, in 50 ordinary and 10,000 non-redeemable 6 per cent. preference shares of £1 each, beyond the registered capital of £100.

SALMON ANTI-FRICTION METAL COMPANY, LIMITED, Northfleet (Kent), increased by £8,000, in 6,000 cumulative preference shares of £1 and 40,000 ordinary shares of 1s. each, beyond the registered capital of £2,000.

CLIFFORD MACHINE TOOLS, LIMITED, Birmingham, increased by £4,900, in £1 ordinary shares, beyond the registered capital of £100. Clifford Motor Components, Limited, holds nearly all the issued shares.

BRADLEY'S (DARLASTON), LIMITED, manufacturers of chilled shot, etc., increased by £25,000, in £1 ordinary shares, beyond the registered capital of £25,000. Staveley Coal & Iron Company, Limited, holds nearly all issued shares.

BRADLEY & CRAVEN, LIMITED, engineers, of Wakefield (Yorks), increased by £50,000, in £1 ordinary shares, beyond the registered capital of £30,000. The £10 shares in the original capital have been sub-divided into shares of £1 each.

LITTON'S MACHINE TOOL COMPANY, LIMITED, London, E.C.1, increased by £50,000, in 40,000 6½ per cent. "A" cumulative redeemable preference and 10,000 6½ per cent. "B" cumulative redeemable preference £1 shares, beyond the registered capital of £20,000. The above shares have been allotted as follows:—Industrial & Commercial Finance Corporation, Limited, 40,000 "A" preference; and Aubrey Litton, 10,000 "B" preference.

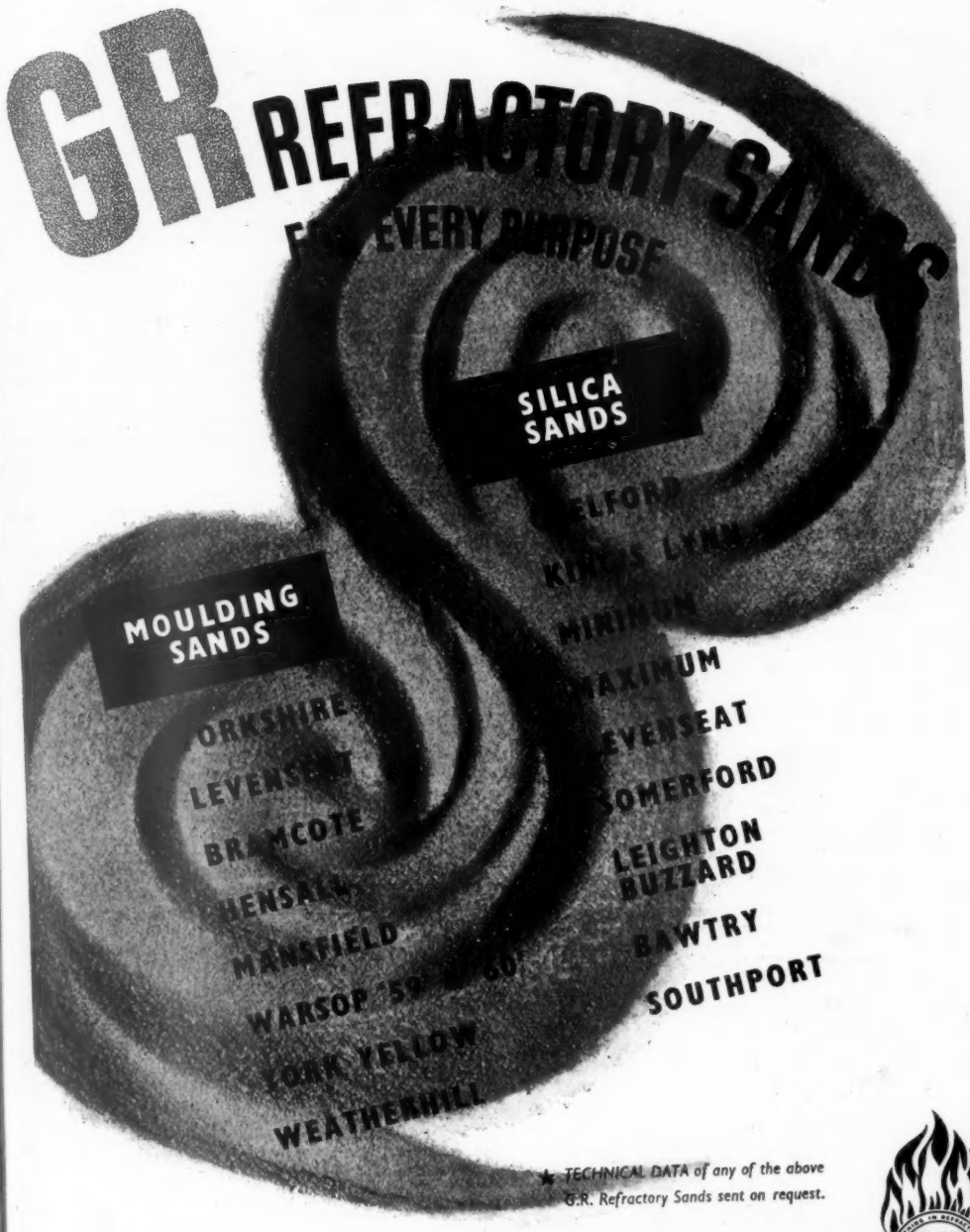
Board Changes

GEO. ADLAM & SONS, LIMITED—Mr. C. V. H. Garnett has ceased to act as a director.

J. SAMUEL WHITE & COMPANY, LIMITED—Sir Charles S. Lillicrap has been appointed to the board.

HANDLEY PAGE, LIMITED—Air Commodore A. V. Harvey has been appointed deputy-chairman.

MR. M. W. YOUNG, youth welfare officer of the Steel, Peech & Tozer branch of the United Steel Companies, Limited, was recently installed as Mayor of Rotherham.



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News in Brief

G. & J. WEIR, LIMITED, have had plans approved to carry out extensions to the components department at Holm Foundry, Cathcart, Glasgow, S.4.

PARTLY because of the shortage of steel and partly owing to a drop in export orders the Reliant Engineering Company, of Tamworth, has declared 70 employees redundant to take effect tomorrow.

FLAMES reached a height of more than 100 ft. when a tar storage and extractor plant at the Templeborough melting shop of the Steel, Peech & Tozer branch of the United Steel Companies, Limited, caught fire recently.

GLOSSARY OF TERMS used for solid-fuel burning and allied appliances has been published as B.S. 1846:1952. It is obtainable from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W.1, price 3s., post free.

ACCORDING TO the *Iron Age*, shell-mould castings of both grey and ductile iron have been successfully produced for six months in a pilot-plant operation. Two men handle all operations on the specially designed four-station machine used to produce the moulds.

EMPLOYEES of Herbert Morris Limited, Loughborough, will visit the Mechanical Handling Exhibition at Olympia, London, on Friday. The firm is making an attractive display at the exhibition, which will include products from the special department which produces foundry plant.

BIRMID WORKS, Smethwick, is the latest to enter the ranks of works journalism and is founding a monthly magazine edited and published by the Sports and Social Club, which will be in circulation among all employees of the three Smethwick Companies in the Birmid Industries combine.

IT IS ANNOUNCED that an important development scheme at the Stanton Ironworks Company, near Ilkeston, has been outlined by Mr. F. Scopes, the managing director, and Mr. J. H. Butler, the chief engineer. This scheme will involve the doubling of the coke-oven plant.

TYNE ENGINEERING EMPLOYERS have agreed, following a meeting with representatives of the local committee of the Confederation of Shipbuilding and Engineering Unions, that maintenance men who have to work during the annual holidays will be paid higher rates. The Unions are to meet the shipbuilding employers on the same question.

A BRASS TABLET bearing the names of the six employees of the Company who lost their lives in the last war was unveiled in the canteen of Thompson Bros. (Bilston), Limited, galvanizing plant manufacturers, etc., of Bilston (Staffs). Long-service awards were later presented to 108 employees who had been with the Company for more than 25 years.

AN ORDER for a new motor passenger-cargo vessel for the North of Scotland & Orkney & Shetland Steam Navigation Company, Limited, Aberdeen, has been placed with Alex. Hall & Company, Limited, Aberdeen. The machinery will consist of a Denny-Sulzer diesel engine with 7 cylinders, developing 2,100 b.h.p. The vessel will be fitted with radar, echo-sounding and direction-finding apparatus.

FERROUS CASTINGS, LIMITED, of Warrington, announce that extensions and alterations comprising a mechanized unit in the foundry; an entirely new fettling shop; a new block of offices; larger and better canteen facilities, and a new washroom, comprising shower baths, etc., are well on the way towards completion, and some of the new buildings will be occupied during the annual holiday in August of this year.

NEW BATHS AND LOCKER ACCOMMODATION, costing £15,000, were opened on May 24 at the works of Miller & Company, Limited, ironfounders, etc., of Edinburgh. Mrs. Gray, wife of Dr. L. T. M. Gray, chairman and managing director of the Company, performed the opening ceremony, and among those present were Mr. Arthur Woodburn, M.P., and Sir William Wallace, chairman of Brown Bros. & Company, Limited.

THE BRISTOL AEROPLANE COMPANY, LIMITED, is to take over another factory at Pallion trading estate, Sunderland, for the manufacture of aero engines. The Company took over a factory on the estate last November and about 250 men are now working. Some key-workers for the new factory will be brought from Bristol, but the majority of the additional 500 men who will be employed will be recruited on Wearside.

MANCHESTER OIL REFINERY, LIMITED, of Twining Road, Trafford Park, Manchester, 17, have developed and placed on the market a fluorescent crack detection ink to be known by the trade name of "Glo-mor." It will be remembered that the process involves the coating of the casting with the ink by dipping or spraying, a wash in carbon-tetrachloride and subsequent inspection under an ultra-violet light source. Even the most minute crack absorbs the ink, which then glows brilliantly under the light.

FURTHER EXPLORATORY TALKS on the Volta River hydro-electric and aluminium scheme have taken place in London between May 26 and 30. Gold Coast Ministers, representatives of U.K. Government departments, and representatives of Aluminium, Limited, and the British Aluminium Company took part. These talks are now to be followed up this week by a visit to the Gold Coast by United Kingdom Government officials and representatives of the aluminium companies for further exploratory discussions on local conditions.

SATISFACTION with the ability of British manufacturers to supply engineering and other equipment for new industrial development in Canada was expressed by Mr. George M. Mason, chief purchasing agent of the Aluminum Company of Canada, Limited, Montreal. Mr. Mason said in London this week that his three weeks' liaison visit to British manufacturers and suppliers had strengthened the likelihood of equipment from this country being used in the great new aluminium project now being constructed at Kitimat, British Columbia.

MEN at the Babcock & Wilcox factory at Renfrew are now engaged on a very substantial share of a £4,000,000 order for turbo-alternators and boilers for South Africa. The order is being shared with the G.E.C. The equipment is for a Johannesburg power station, and Councillor G. B. Gordon, Johannesburg finance committee chairman, said deliveries were expected to begin in 12 to 18 months. The power station should be in use by 1955; all-British equipment will be used. Men from the Renfrew factory will supervise the installation of the boilers in South Africa.

A CHANGE in British industry from the manufacture of light consumer goods to heavy capital goods was advocated by Mr. D. R. Griffiths, director of the Incorporated Sales Managers Association, when he addressed members of the Birmingham branch at their annual meeting in Birmingham on May 26. The present pattern of production is not adapted to making the goods that could make the biggest profits abroad, said Mr. Griffiths. Sir Basil R. G. Tangye was installed president of the Birmingham branch of the Association with Mr. D. Beatson Hird as chairman for the ensuing year.

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Raw Material Markets

Iron and Steel

The main obstacle to the much-needed improvement in steel production is the shortage of scrap. The scrap drive has been intensified in some parts of the country and there have been some encouraging results, but so long as imports remain at present levels, no appreciable improvement in the supply position can be expected. Deliveries from abroad are irregular and uncertain, especially from Germany, and efforts are constantly being made to obtain supplies from other oversea markets.

Pig-iron production generally continues to be satisfactory from the furnaces in blast, and more units will be blown in when sufficient coke is available. At present, producers are faced with the problem of trying to satisfy both the steelworks and the foundries on outputs which are much below the needs of both. With the priority now being given to the steelworks, foundry grades of pig-iron are correspondingly reduced, particularly hematite and high-phosphoric pig-iron.

The engineering and speciality foundries are well employed and more pig-iron is in demand by them than available supplies can satisfy. The low- and medium-phosphoric irons remain scarce and hematite is more stringent that it has been for a long time. Some furnaces on the north-east coast have suspended deliveries entirely to their customers, and other units can only manage a fraction of the normal allocation. The cause of the deficiency it is understood is due both shortage of ore as well as to the needs of local steelworks, but the resultant loss of supplies is having serious consequences for the foundries involved.

The jobbing and light foundries are satisfactorily employed, and there is no difficulty in disposing of available supplies of high-phosphoric pig-iron.

At both the steelworks and foundries available supplies of raw materials are dangerously low. Normally at this period of the year stocks of scrap, pig-iron, and coke would be built up to allow for any winter emergency. Foundry coke is coming forward regularly, but there is little to spare for stock, while ganister, limestone, and firebricks are received to requirements.

No appreciable improvement in working conditions at the re-rollers is possible, and most of them continue on short time. Demands for small sections, bars, and strip are far in excess of output. The sheet re-rollers, who continue to be heavily employed, are in need of more sheet bars.

Non-ferrous Metals

In confirmation of the reports about the rapidly increasing supply of zinc and the passing away of conditions of stringency, it was announced last week that allocations under the I.M.C. plan are to lapse for the remainder of the present quarter. But more than this, it has been decided not to arrange any quotas for the third quarter, since it is apparently felt that supplies are so plentiful as to preclude the necessity for this course. Unless there is a remarkable and altogether unexpected change in the situation between now and the autumn, it must be concluded that no allocations will be made for the last quarter of the year. In that event it seems reasonable to suppose that, so far as zinc is concerned, the allocation scheme is finished. In lead, it has never been considered needful to operate the plan, and that leaves only copper among the chief non-ferrous metals. Here, it must be admitted, there does not seem to be much chance of any let-up in the near future, but it is a truism that in the world of non-ferrous metals changes come very quickly, and we have certainly had proof of it in lead. That being so, and bearing in mind the ever-growing world production in copper, it would not be at all surprising if a change were to come over the situation without much warning. The outcome of the U.S.-Chilean talks is not yet known, but it is a fact that copper from these important South American copper fields is now on offer well below 40 cents per lb.

The London tin market closed after the midday session last Friday and reopened on Tuesday. On the whole, tin has been quite a firm market. There appears to be rather a downward drift in London Metal Exchange stocks, due probably to withdrawals of English tin for the Continent. It has been reported that Bolivia is making a sale of her accumulated concentrates to the United States on the basis of 121½ cents for tin metal, from which it is evident that the producers have been obliged to face up to the facts of the situation and accept the current price. There are hopes, too, that negotiations for a contract covering the sale of the tin mines' production to America will soon reopen and no doubt a settlement will be reached.

Official tin prices on the London Metal Exchange were:—

Cash—Thursday, £971 to £972; Friday, £973 to £974; Tuesday, £973 to £976; Wednesday, £977 to £978.

Three Months—Thursday, £962 to £963; Friday, £965 to £966; Tuesday, £964 to £966; Wednesday, £968 to £969.

Mining Institution Merger

An event of considerable importance to the mining community of this country is due to take effect on July 1, when the South Western Society of Mining Engineers and the South Wales Institute of Engineers become merged. At the same time, the South Wales Institute of Engineers will become federated with the Institution of Mining Engineers. The South Western Society of Mining Engineers was formed in 1947 for the advancement of the science and practice of the mining of coal and other stratified deposits and the promotion of the acquisition of the knowledge necessary for the control and direction of such mining operations. For many years it has been apparent that it would be advantageous for the two Institutes to be merged into one, and after negotiations lasting over a period of many months agreement was reached and the details of the merger were successfully completed.

The South Western Society of Mining Engineers will, after July 1, cease to exist as such, and their members will become members of the South Wales Institute of Engineers. The South Wales Institute of Engineers is one of the oldest in the country, having been founded in 1857. It was granted a Royal Charter of Incorporation in 1881. In carrying out the functions for which the Institute was founded, it has not only played its part in advancing technical knowledge, but its members have made important contributions directed towards diminishing the hazards of mining and other engineering operations. The Institution of Mining Engineers was established in 1889, and was incorporated by Royal Charter in 1915. It was founded as a federation of much older district institutes, and its objects are the advancement of coal and iron-ore mining and allied industries and the promotion of the acquisition of the knowledge necessary for the control and direction of mining operations. There are at present eight separate institutes federated with the Institution.